JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY
AND NATIONAL MUSEUM

VOL. XXV No. 3 (112) January 1966

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(Published 15.4.66)

Price Shs. 15/-

All correspondence in connection with this Journal should be addressed to: The Secretary, East Africa Natural History Society, P.O. Box 4486, Nairobi, Kenya.

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J.E.Afr.Nat.Hist.Soc. Vol.XXV No.3 (112) January 1966

CHECK LIST OF ELOPOID AND CLUPEOID FISHES IN EAST AFRICAN COASTAL WATERS

By

G.F. LOSSE
(East African Marine Fisheries Research Organization, Zanzibar.)

Introduction

During preliminary biological studies of the economically important fishes of the suborders Elopoidei and Clupeoidei in East African coastal waters, it was found that due to considerable confusion in the existing literature and the taxonomy of many genera, accurate identifications were often difficult.

A large collection of elopoid and clupeoid fishes has been made. Specimens have been obtained from purse-seine catches, by trawling in estuaries and shallow bays, by seining, handnetting under lamps at night, and from the catches of indigenous fishermen. A representative part of this collection has now been deposited in the British Museum (Natural History), London, where I was able to examine further material from the Western Indian Ocean during the summer of 1964. Based on these collections this check list has been prepared; a review on the taxonomy, fishery and existing biological knowledge of elopoid and clupeoid species in the East African area is in preparation.

Twenty-one species, representing seven families are listed here; four not previously published distributional records are indicated by asterisks.

Classification to familial level is based on Whitehead, P.J.P. (1963 a). Keys refer only to species listed and adult fishes. In the synonymy reference is made only to the original description and other subsequent records from the area. Only those localities are listed from which I have examined specimens.

East Africa refers to the coastal waters of Kenya and Tanzania and the offshore islands of Pemba, Zanzibar and Mafia; Eastern Africa refers to the eastern side of the African continent, i.e. from the Red Sea to Natal.

Key to the Suborders and Families

1. Lateral line present on body; abdominal scutes and pelvic scute always absent ..... Suborder ELOPOIDEI
   - (i) Mouth terminal; upper jaw bordered by maxillae and premaxillae:
     - (a) Last dorsal ray not filamentous; pseudobranch exposed .... Family _Elopidae_
     - (b) Last dorsal ray filamentous; pseudobranch not exposed ...... Family _Megalopidae_
   - (ii) Mouth inferior; upper jaw bordered by premaxillae only .... Family _Albulidae_

2. Lateral line absent on body; abdominal scutes often present, pelvic scute always present .... Suborder CLUPEOIDEI
   - (i) Abdominal scutes absent:
     - (a) Body highly compressed; jaw teeth large and fang-like; dorsal origin much nearer caudal base than snout ..... Family _Chirocentridae_
     - (b) Body rounded; jaw teeth small, not fang-like; dorsal origin about mid-way between snout tip and caudal base .... Family _Dussumieriidae_
   - (ii) Abdominal scutes present:
     - (a) Mouth terminal or sub-terminal, snout not pig-like; maxilla does not extend beyond posterior border of eye .... Family _Clupeidae_
     - (b) Mouth inferior, snout pig-like; maxilla extends beyond posterior border of eye .... Family _Engraulidae_

Suborder ELOPOIDEI

Family ELOPIDAE

Tenpounders

ELOPS Linnaeus, 1766

Elops Linnaeus, 1766, _Syst.Nat.ed_.12, _1_ : 518 (type: _Elops saurus_). A single species in East African waters.

Elops machnata (Forskål)

Argentina machnata Forskål, 1775, _Descript.Animal_ : xii, 68 (type locality: Djedda, Red Sea).

Elops machnata: Günther, 1866, Fishes of Zanzibar : 121, fig. (caudal) (Zanzibar): Whitehead, 1962, _Ann.Mag.nat.Hist_. (13) _5_ : 321 (Revision all spp.; Indo-Pacific specimens): Losse, 1964, _E.A.M.F.R.O. Ann. Rep_. 1963 : 12 (Zanzibar Channel).

Elops saurus: (part) Günther, 1868, _Cat.Fish.Brit.Mus_. _7_ : 470 (Zanzibar, East Africa); Boulenger, 1909, _Cat.Fresh Water Fish Africa_, _1_ : 25, fig. 17 (Zanzibar); (part) Copley, 1952,

Game Fishes of Africa : 53, fig. 34 (Malindi, Kilifi, Mombasa); Morrow, 1954, Ann.Mag.nat.Hist. (12) 7 : 803 (Shimoni, Kenya).

VERNACULAR NAMES: Makuronga (Malindi), Munyimbi (Shimoni), Mkizi (Zanzibar).
LOCALITIES: Dar-es-Salaam, Zanzibar, Shimoni, Mombasa, Malindi, Fundishu, Lamu.
RANGE: Eastern coast of Africa from the Red Sea to Algoa Bay; Seychelles, Aldabra, Comores, Madagascar, Mauritius. Widespread in Indo-Pacific to the East Indies, China, Japan and Hawaii.

Family MEGALOPIDAE

Tarpons

MEGALOPS Lacépède, 1803

Megalops Lacépède, 1803, Hist.Nat.Poiss., 5 : 289 (types: Megalops filamentosus Lacépède = Clupea cyprinoides Broussonet).
A single Indo-Pacific species.

Megalops cyprinoides (Broussonet)

Clupea cyprinoides Broussonet, 1782, Ichthyol. (no pagination) pl. 9.

Elops cyprinoides: Günther, 1866, Fishes of Zanzibar : 122 (East Africa); Martens, 1869, in Deckens Reise Ost Africa, 3 (1) : 143 (Pangani River, Zanzibar).

Megalops cyprinoides: Günther, 1868, Cat.Fish.Brit.Mus. 7 : 471 (Zanzibar); Copley, 1952, Game Fishes of Africa : 54, fig. 35, pl. 3 (upper fig.) (Mombasa, Tanga, Zanzibar, Mafia); Losse, 1964, E.A.M.F.R.O. Ann. Rep. 1963 : 12 (Zanzibar Channel).

VERNACULAR NAMES: Pawale (general), Kumpangu (Malindi).
LOCALITIES: Dar-es-Salaam, Zanzibar, Mombasa, Malindi.
RANGE: Eastern coast of Africa from Somalia to Algoa Bay; Seychelles, Aldabra, Comores, Madagascar, Mauritius. Widespread in Indo-Pacific, to the East Indies, Australia, Philippines and China.

Family ALBULIDAE

Lady Fishes

ALBULA Scopoli, 1777

Albula Scopoli, 1777, Introd.Hist.Nat. : 450 (on Gronow) (type: Esox vulpes Linnaeus).
A single species in all tropical seas.

Albula vulpes (Linnaeus)

Esox vulpes Linnaeus, 1758, Syst.Nat.ed.10, 1 : 313 (On Bone Fish Catesby, 1737, Hist.Nat.Carolina, pl. 2, fig. 1; Bahamas).

Butirinus glossodontus: Günther, 1866, Fishes of Zanzibar : 120 (Zanzibar).

Albula conorhynchus: Günther, 1868, Cat.Fish Brit.Mus., 7 : 468 (Zanzibar).

Albula vulpes: Copley, 1952, Game Fishes of Africa, : 56, pl. 3 (lower fig.) (East African coast; Lamu, Malindi, Kilifi, Mombasa).

VERNACULAR NAMES: Mborode (Malindi), Mnymbi (Zanzibar, Shimoni).
LOCALITIES: Zanzibar, Mombasa.
RANGE: Eastern coast of Africa from the Red Sea to Algoa Bay; Seychelles, Aldabra, Comores, Madagascar, Mauritius, Reunion. Cosmopolitan in tropical seas.

Suborder CLUPEOIDEI

Family CHIROCENTRIDAE

Wolf Herrings

CHIROCENTRUS Cuvier, 1817

Chirocentrus Cuvier, 1817, Regne Animal, 2 : 178 (type: Clupea dorab Forskål).
A single species in East African waters.

Chirocentrus dorab (Forskål)

Clupea dorab Forskål, 1775, Descript. Animal : xii, 72 (type locality: Djedda).

Chirocentrus dorab: Valenciennes, 1846, Hist.Nat.Poiss., 19 : 150, pl. 565 (Zanzibar); Günther, 1866, Fishes of Zanzibar : 120 (Zanzibar); Idem, 1868, Cat.Fish.Brit.Mus., 7 : 475 (Zanzibar); Bonde, 1934, Ann.Natal Mus. (7), 3 : 437 (Zanzibar); Copley, 1952, Game Fishes of Africa, : 56, pl. 5 (upper fig.) (East Africa: Lamu, Mombasa, Zanzibar, Dar-es-Salaam, Mafia); Morrow, 1954, Ann.Mag.nat.Hist. (12) 7 : 804 (Pemba); Losse, 1964, E.A.M.F.R.O. Ann.Rep. 1963 : 12 (Zanzibar Channel).

VERNACULAR NAMES: Bahanafu (Malindi), Panga (Mombasa), Mkonge (Zanzibar, Shimoni).
LOCALITIES: Dar-es-Salaam, Zanzibar, Mombasa, Malindi, Lamu.
RANGE: Eastern coast of Africa from the Red Sea to Natal; Seychelles, Aldabra, Comores, Madagascar, Mauritius. Widespread in Indo-Pacific, eastwards to the Philippines, China, Australia and Melanesia.

Family DUSSUMIERIIDAE

Round Herrings

Key to the Genera

1. Branchiostegal rays 14-16: adults large (>130 mm. standard length) .... Dussumieria

2. Branchiostegal rays 6-7: adults small (<80 mm. standard length) .... Spratelloides

DUSSUMIERIA Valenciennes, 1857

Dussumieria Valenciennes, 1847, Hist.Nat.Poiss., 20 : 467 (type: Dussumieria acuta Valenciennes).
A single species widespread in the Indo-Pacific region.

Dussumieria acuta Valenciennes

Dussumieria acuta Valenciennes, 1847, Hist.Nat.Poiss., 20 : 467, pl. 606 (type locality: Bombay); Whitehead, 1963, Bull.Brit. Mus.nat.Hist. (Zool.), 10 (6) : 312, figs. 1-5 (Revision, synonymy; Indo-Pacific specimens); Losse, 1964, E.A.M.F.R.O. Ann.Rep. 1963 : 12 (Zanzibar Channel).

VERNACULAR NAMES: Dagaa la upapa (Zanzibar).
LOCALITIES: Dar-es-Salaam, Zanzibar, Kenya, (a single specimen from the stomach of a sailfish).
RANGE: Eastern coast of Africa from the Red Sea to Madagascar. Indo-Pacific east to Japan.

SPRATELLOIDES Bleeker, 1852

Spratelloides Bleeker, 1852, Natuurk.Tijdschr.Ned.Ind., 2 : 214 (type: Clupea argyrotaeniata Bleeker = Clupea gracilis Schelegel).

Key to the Species

1. Anal rays 11-14; a prominent silver lateral band ... S. gracilis

2. Anal rays 9-11; no silver band, whole of sides silvery .... S. delicatulus

Spratelloides gracilis (Schlegel)

Clupea gracilis Schlegel, 1846, Faun.Japan Poiss., pts. 10-14 : 238, pl. 108, fig. 2 (type locality: Japan).

Spratelloides japonicus: Morrow, 1954, Ann.Mag.nat.Hist. (12) 7 : 804 (Mkoani Harbour, Pemba).

Spratelloides gracilis: Whitehead, 1963, Bull.Brit.Mus.nat.Hist. (Zool.), 10 (6): 388, figs. 15-18 (Revision, synonymy: Red Sea and Pacific specimens).

VERNACULAR NAMES: None known.
LOCALITIES: Mafia, Zanzibar.
RANGE: East African coast. Elsewhere: Red Sea, Indo-Pacific east to Japan and Samoa.

Spratelloides delicatulus (Bennett)

Clupea delicatula Bennett, 1831, Proc.zool.Soc.Lond., 1 : 168 (type locality: Mauritius).

Spratelloides delicatulus: Jatzow & Lenz, 1899, Abhandl. Senckenberg. Naturf.Ges., xxi, 3 : 526 (no locality, East African collection); Morrow, 1954, Ann.Mag.nat.Hist. (12) 7 : 804 (Mkoani Harbour, Pemba); Whitehead, 1963, Bull.Brit.Mus.nat.Hist. (Zool.), 10 (6) : 345, figs. 16-17 (Revision, synonymy; Indo-Pacific specimens).

VERNACULAR NAMES: Dagaa (general).
LOCALITIES: Mafia, Zanzibar, Kilifi.
RANGE: Eastern coast of Africa from the Red Sea to Zululand; Seychelles, Aldabra, Comores, Madagascar, Mauritius. Widespread in Indo-Pacific, eastwards to Australia.

Family CLUPEIDAE

Herrings

Key to the Genera

1. Anal short, of less than 30 rays; hypomaxillary bone absent:
   - (i) Upper jaw without deep median notch:
     - (a) Few (3-5) fronto-parietal striae, last two anal rays not enlarged, vertical striae of scales generally complete .... Herklotsichthys
     - (b) Many (more than 7) fronto-parietal striae; last two anal rays enlarged; vertical striae of scales incomplete .... Sardinella
   - (ii) Upper jaw with prominent deep median notch .... Hilsa
2. Anal long, of more than 30 rays; a small toothed hypomaxillary bone present .... Pellona

HERKLOTSICHTHYS Whitley, 1951.

Herklotsichthys Whitley, 1951, Proc.Roy.zool.Soc.N.S.W. 1949-50 : 67.

Harengula Valenciennes (part i.e. Indo-Pacific species only), 1847, Hist.nat.Poiss., 20 : 301 (type: Harengula latulus Val. = Clupea

macropthalma Ranzanzi, designated by Gill, 1861, Proc.Acad.nat. Sci.Philad. : 36).

Indo-Pacific species of Harengula have been separated from New World species on the basis of a toothed hypomaxilla being present in the latter (Berry, 1963); Herklotsichthys Whitley replaces Harengula Valenciennes for the Indo-Pacific species (Whitehead, 1963 b).

Two species occur in the Western Indian Ocean, H. punctatus (Rüpp.) and H. vittatus (Val.); although the latter has been recorded from Natal (Barnard, 1925; Smith, 1961), Mauritius (Baissac, 1951), Madagascar (Fourmanoir, 1957) and the Gulf of Aden (Whitehead, 1964), I can find no record of occurrence in East African waters.

Herklotsichthys punctatus (Rüppell)

Clupea punctata Rüppell, 1837, Neue Wirbelth.Fische : 78, pl. 21, fig. 2 (type locality: Red Sea).

Alosa punctata: Günther, 1866, Fishes of Zanzibar : 23 (Zanzibar).

Clupea venenosa: Günther, 1868, Cat.Fish.Brit.Mus., 7 : 449 (Zanzibar).

Harengula punctata: Regan, 1917, Ann.Mag.nat.Hist. (8) 19 : 390 (East Africa); Losse, 1964, E.A.M.F.R.O.Ann.Rep. 1963 : 11 (Zanzibar Channel).

VERNACULAR NAMES: Dagaa la upapa (Zanzibar), Simu (Kenya), Dagaa (small specimens - general).
LOCALITIES: Dar-es-Salaam, Zanzibar, Tanga, Mombasa, Milindi, Formosa Bay.
RANGE: Eastern coast of Africa from the Red Sea to Durban; Seychelles, Aldabra, Madagascar, Mauritius. Widespread in Indo-Pacific, east to Japan, Australia and Polynesia.

SARDINELLA Valenciennes, 1847

Sardinella Valenciennes, 1847, Hist.Nat.Poiss., 20 : 28 (type: Sardinella aurita Val., designated by Gill, 1861, Proc.Acad.nat. Sci.Philad.: 35).

Key to the Species

1. Abdominal scutes strongly keeled, sharp and exposed; abdomen highly compressed; 46 or more gill rakers on lower part of 1st gill arch:
   - (i) Pelvic rays 9; more than 150 gill rakers on lower part of 1st gill arch .... S. longiceps
   - (ii) Pelvic rays 8; less than 60 gill rakers on lower part of 1st gill arch:
     - (a) Body depth 31.0% (generally 32% -34%) of standard length; 46-54 gill rakers on lower part of 1st gill arch........ S. bulan
     - (b) Body depth 25.0% - 31.6% (generally 26% - 28%) of standard length; 47-57 gill rakers on lower part of 1st gill arch .... S. jussieu

2. Abdominal scutes feebly keeled, hardly exposed, abdomen smooth and rounded: 35-43 gill rakers on lower part of 1st gill arch .... S. sirm

Sardinella longiceps Valenciennes

Sardinella longiceps Valenciennes, 1847, Hist.Nat.Poiss., 20 : (198) 273 (type locality: Pondicherry); Regan, 1917, Ann.Mag.nat.Hist. (8) 19 : 379 (Mombasa).

LOCALITIES: Mombasa.
RANGE: Eastern coast of Africa from the Gulf of Aden to Mombasa; Seychelles. Indo-Pacific east to Indonesia and the Philippines.

Sardinella bulan (Bleeker)

Clupalosa bulan Bleeker, 1849, Verh.Bat.Gen., 22 : 12 (type locality: Java).

Alosa kowal: Günther, 1866, Fishes of Zanzibar : 123 (Zanzibar).

Clupea kowal: Günther, 1868, Cat.Fish.Brit.Mus., 7 : 450 (Zanzibar).

Sardinella perforata: Regan, 1917, Ann.Mag.nat.Hist. (8) 19 : 382 (Indian Ocean); Losse, 1964, E.A.M.F.R.O. Ann.Rep. 1963 : 11 (Zanzibar Channel).

Sardinella bulan: Whitehead, 1964, Bull.Brit.Mus.nat.Hist.(Zool.) 12 (7) : 250 (Zanzibar).

VERNACULAR NAMES: Dagaa la upapa (Zanzibar), Dagaa (small specimens - general).
LOCALITIES: Zanzibar, Pangani estuary, Tanga, Mombasa.
RANGE: Eastern coast of Africa from the Gulf of Aden to Lourenco Marques; Madagascar. Indo-Pacific to the East Indies, Philippines, Siam, Amoy and Polynesia.

Sardinella jussieu (Lacépède)

Clupanodon jussieu Lacépède, 1803, Hist.Nat.Poiss., 5 : 469, 474, pl. 11, fig. 2 (type locality: Mauritius).

?Clupea tembang: Jatzow & Lenz, 1899, Abhandl.Senckenberg.Naturf.Ges., xxi, 3 : 526 (Zanzibar).

Sardinella gibbosa: Regan, 1917, Ann.Mag.nat.Hist. (8) 19 : 383 (Mombasa, Indian Ocean).

Sardinella jussieu: Bonde, 1934, Ann.Natal Mus. (7) 3 : 437 (Zanzibar); Losse, 1964, E.A.M.F.R.O. Ann.Rep. 1963 : 11 (Zanzibar Channel).

VERNACULAR NAMES: Dagaa la upapa (Zanzibar), Simu (Kenya), Dagaa (small specimens - general).
LOCALITIES: Dar-es-Salaam, Zanzibar, Tanga, Mombasa, Malindi.
RANGE: Eastern coast of Africa from the Red Sea to Natal; Seychelles,

Mauritius, Madagascar. Widespread in Indo-Pacific; East Indies, China, Australia, Micronesia and Polynesia.

Sardinella sirm (Walbaum)

Clupea sirm Walbaum, Artedi Pisc., 3 : 38 (on Forskål, 1775, Descript. Animal : 17); Günther, 1868, Cat.Fish.Brit.Mus., 7 : 425 (Zanzibar).

Alosa sirm: Günther, 1866, Fishes of Zanzibar : 123 (Zanzibar).

Sardinella sirm: Regan, 1917, Ann.Mag.nat.Hist. (8) 19 : 385 (Zanzibar, Indian Ocean); Losse, 1964, E.A.M.F.R.O. Ann.Rep. 1963 : 11 (Zanzibar Channel).

VERNACULAR NAMES: Dagaa la upapa (Zanzibar), Simu (Kenya).
LOCALITIES: Dar-es-Salaam, Zanzibar, Mombasa.
RANGE: Eastern coast of Africa from the Red Sea to Madagascar; Seychelles, Aldabra. Widespread in Indo-Pacific; East Indies, Philippines, China, Micronesia and Polynesia.

HILSA Regan, 1917.

Hilsa Regan, 1917 Ann.Mag.nat.Hist. (8) 19 : 303 (type: Clupea durbanensis Regan).
A single species in East African coastal waters.

Hilsa kelee (Cuvier)

Clupea kelee Cuvier, 1829, Regne Animal., ed. 2, 2 : 320 (name in footnote, based on Kelee Russell, 1803, Fishes of Coromandel, 2 : 75, pl. 195; type locality: Vizagapatam).

Alosa chapra: Günther, 1866, Fishes of Zanzibar : 123 (Zanzibar).

Clupea ilisha: Günther, 1868, Cat.Fish.Brit.Mus., 7 : 445 (Zanzibar).

Hilsa kelee: Whitehead, 1964, Bull.Brit.Mus.nat.Hist. (Zool.) 12 (4) : 129, fig. 8 (Revision, synonymy; Sabaki estuary, Kenya).

VERNACULAR NAMES: Makrenge (Mombasa), Pawali (general).
LOCALITIES: Ruvu estuary, Pangani estuary, Mombasa, Malindi, Sabaki estuary.
RANGE: Eastern coast of Africa from the Gulf of Aden to Natal; Madagascar. Western Indo-Pacific to Burma and Siam.

PELLONA Valenciennes, 1847.

Pellona Valenciennes, 1847, Hist.Nat.Poiss., 20 : (218) 300 (type: Pellona orbygnyana Val., designated by Gill, 1861, Proc.Acad.nat.Sci.Philad.,: 38).
A single Indo-Pacific species*.

Pellona ditchela Valenciennes

Pellona ditchela Valenciennes, 1847, Hist.Nat.Poiss., 20 : (228) 314 (on Ditchelee Russell, 1803, Fishes of Coromandel, 2 : 72 pl. 188; type locality: Vizagapatam).

Pellona ditchoa: Günther, 1866, Fishes of Zanzibar : 122 (East Africa); Idem, 1868, Cat.Fish.Brit.Mus., 7 : 455 (Zanzibar, East Africa).

Neosteus ditchela: Norman, 1923, Ann.Mag.nat.Hist. (9) 11 : 17 (East Africa).

VERNACULAR NAMES: Chaa (general), Simu koko (Malindi), Simu (general).
LOCALITIES: Ruvu estuary, Pangani estuary, Zanzibar, Mombasa, Malindi, Formosa Bay.
RANGE: Eastern coast of Africa from Kenya to Delagoa Bay; Madagascar. Coasts of India.

* The genus Pellona, primarily composed of New World species, differs from the Indo-Pacific genus Ilisha by the possession of a toothed hypomaxilla, lying between the end of the pre-maxillary and centre of maxillary jaw bones. In Ilisha this bone is replaced by a ligament; this genus has not been recorded from our area.

Family ENGRAULIDAE

Anchovies

Key to the Genera

1. Abdominal scutes confined to pre-pelvic region....... Stolephorus
2. Post-pelvic scutes present:
   (i) No pre-pectoral scutes; pseudobranch exposed.... Thrissina
   (ii) Pre-pectoral scutes present; pseudobranch not exposed .... Thryssa

STOLEPHORUS Lacépède, 1803.

Stolephorus Lacépède, 1803, Hist.Nat.Poiss., 5 : 381 (type: Stolephorus commersonii Lacepede).

Key to the Species

1. Anal origin under or behind last dorsal ray; muscular portion of isthmus short, not reaching posterior border of branchiostegal membranes:
   (i) Posterior tip of maxilla pointed, projecting well behind 2nd supramaxilla .... S. heterolobus
   (ii) Posterior tip of maxilla truncated, hardly projecting beyond 2nd supramaxilla..S. buccaneeri

2. Anal origin under posterior third of dorsal base; muscular portion of isthmus long, projecting forward beyond hind border of branchiostegal membranes:
   (i) Posterior tip of maxilla does not project beyond posterior border of pre-operculum; abdominal scutes 4-5 .... S. indicus
   (ii) Posterior tip of maxilla reaches gill opening; abdominal scutes 4-7............. S. commersoni

*Stolephorus heterolobus (Rüppell)

Engraulis heteroloba Rüppell, 1837, Neue Wirbelth.Fische : 79, pl.21, fig. 4 (type locality: Massaua).

VERNACULAR NAMES: Dagaa uronda (Zanzibar), Kumbu (Kenya).
LOCALITIES: Dar-es-Salaam, Zanzibar, Mombasa, Malindi.
RANGE: East African coast, Madagascar, Red Sea and the Suez Canal (Whitehead, 1964); Madras, East Indies and Australia.

*Stolephorus buccaneeri Strasburg

Stolephorus buccaneeri Strasburg, 1960, Pacific Science, 14 (4) : 396 (type locality: Hawaii).

VERNACULAR NAMES: None known.
LOCALITIES: Mombasa (Port Tudor).
RANGE: East African coast (only known from Mombasa); elsewhere: Durban, Red Sea, Persian Gulf, "Arabia" (Whitehead, 1964) and Hawaii.

Stolephorus indicus (Van Hasselt)

Engraulis indicus Van Hasselt, 1823, Alg.Konst-en Letter-Bode, 1, (23) 329 (type locality: Java).

Engraulis russellii: Jatzow & Lenz, 1899, Abhandl.Senckenberg Naturf. Ges., xxi, 3 : 525 (Zanzibar).

Anchoviella indica: Morrow, 1954, Ann.Mag.nat.Hist. (12) 7 : 804 (Mkoani harbour, Pemba).

Stolephorus indicus: Losse, 1964, E.A.M.F.R.O. Ann.Rep.1963 : 12 (Zanzibar Channel).

VERNACULAR NAMES: Dagaa uronde (Zanzibar), Kumbu (Kenya).
LOCALITIES: Dar-es-Salaam, Zanzibar, Mombasa, Malindi.
RANGE: Eastern coast of Africa from the Red Sea to Natal; Madagascar, Aldabra. Widespread in Indo-Pacific to the East Indies, Philippines, China, Formosa, Melanesia, Micronesia and Polynesia.

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* Not previously recorded from East Africa.

Stolephorus commersoni Lacépède

Stolephorus commersoni Lacépède, 1803, Hist.Nat.Poiss., 5 : 381, pl.12, fig. 1 (no locality, on Commerson).

Engraulis brownii: Günther, 1866, Fishes of Zanzibar : 123 (Zanzibar).

Engraulis commersonianus: Günther, 1868, Cat.Fish.Brit.Mus., 7 : 388 (Zanzibar).

VERNACULAR NAMES: Kumbu (Kenya).
LOCALITIES: Zanzibar, Ruvu estuary, Pangani estuary, Mombasa, Malindi.
RANGE: East African coast south to Durban; Madagascar, Mauritius. Widespread in Indo-Pacific; Arabia, East Indies, Philippines, China, Formosa, Korea and Polynesia.

THRISSINA Jordan & Seal, 1925

Thrissina Jordan & Seal, 1925, Copeia No. 141 : 30 (type: Clupea baelama Forskål).
A monotypic, Indo-Pacific genus.

Thrissina baelama (Forskål)

Clupea baelama Forskål, Descript. Animal, : 72 (type locality: Djedda).

Engraulis boelama (mis-spelt): Günther, 1866, Fishes of Zanzibar : 123 (Zanzibar); Idem, 1868, Cat.Fish.Brit.Mus., 7 : 393 (Zanzibar); Idem, 1871, Proc.Zool.Soc.London : 671 (Zanzibar).

VERNACULAR NAMES: Dagaa (Zanzibar), Simu (Kenya.
Localities: Dar-es-Salaam, Zanzibar, Mombasa, Malindi.
RANGE: Eastern coast of Africa from the Red Sea to Madagascar; Seychelles, Mauritius, Reunion. Widespread in Indo-Pacific, to the Philippines, Melanesia, Micronesia and Polynesia.

THRYSSA Cuvier, 1829

Thryssa Cuvier, 1829, Régne Animal, ed. 2, 2 : 323. (type: Clupea setirostris Broussonet).

Key to the Species

1. Maxilla does not extend beyond tip of pectoral fins .... T. vitrirostris

2. Maxilla extends beyond tip of pelvic fins.......... T. setirostris

*Thryssa vitrirostris (Gilchrist & Thompson)

Engraulis vitrirostris Gilchrist & Thompson, 1908-11, Ann.S.Afr.Mus. 6 : 201 (localities: Natal; inner harbour, Durban).

* Not previously recorded from East Africa.

VERNACULAR NAMES: None known.
LOCALITIES: Zanzibar, Ruvu estuary, Pangani estuary, Mombasa, Malindi, Formosa Bay.
RANGE: East African coast south to East London; Madagascar, Aldabra. Persian Gulf of Oman (Whitehead, 1964), coast of India.

Thryssa setirostris (Broussonet)

Clupea setirostris Broussonet, 1782, *Ichth*., 1, pl. 2 (type locality: Society Islands).

VERNACULAR NAMES: None known.
LOCALITIES: Ruvu estuary, Pangani estuary, Malindi, Formosa Bay.
RANGE: Eastern coast of Africa from the Red Sea to Natal; Madagascar, Aldabra. Widespread in Indo-Pacific, to China, Queensland and Polynesia.

* Not previously recorded from East Africa

Acknowledgements

The author wishes to express his thanks to the Director and Staff of the East African Marine Fisheries Research Organization, Zanzibar, for critically reading the manuscript.

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(Received for publication 1st July 1965)

A LIST OF BIRDS SEEN IN SOUTHERN TANZANIA

By

C.J. TWEEDY

Introduction

Scope of the List

The attached list of birds seen in southern Tanzania between July 30th 1963 and July 18th 1964 gives records of 105 species exactly identified, together with a further general note on 7 families of which representatives were seen but not specified with absolute certainty. Of these 105 species, 71 were seen within the school grounds of St. Joseph's College, Chidya, near Masasi, in the Mtwara region, an area of perhaps three quarters of a square mile in extent; and a further 13 species were seen within five miles of the school boundary, half of them within a mile of it. Thus only 21 species represent what I assume to be the large number of southern Tanzanian - birds - especially waders and waterfowl - which seldom or never come near Chidya.

At the same time, even with regard to the birds on the list, it must be borne in mind that they are the result of observations made largely in spare time over less than one calendar year, during which I was absent from southern Tanzania from December 15th to January 10th; and that even within the limited time available many birds were seen which I could not certainly identify. It will thus be seen that the negative evidence of this list is only to a small extent valuable, and that it is basically little more than a preliminary check-list of the birds of St. Joseph's College, Chidya.

Chidya Ecologically

Chidya is a settlement consisting of the buildings directly connected with a junior secondary boarding school for about 300 boys, and with the small local medical dispensary. Situated some twenty miles east-north-east of Masasi and three due west of the main Makonde Plateau escarpment, it is on a low ridge about five miles long, at a height of about 2,000 ft above sea-level. It is some 500 ft at its highest above the large plain stretching to the Ruvuma River fifty miles to the south, and a hundred or two miles towards the southern highlands in the far west, in the direction of Lake Nyasa. Geologically it is an outrider to the Makonde Plateau.

The buildings at Chidya are scattered about an area to various degrees cleared of the surrounding Brachystegia woodland. There are many mango trees, two open playing-fields and cultivated lands. During the year concerned, the remaining old-style African school-buildings were being steadily replaced by or transformed into modern buildings with corrugated iron roofs, but a number of staff houses were being retained unaltered with thatched roofs. There is permanent water in two wells about a couple of hundred feet below the school, some of which is piped up as a constant supply. (Measurements of heights and distances in this Introduction are all approximate).

Exceptional Weather

It will be noticed that a number of passerine species usually

typical of Chidya were reduced in numbers or absent for several weeks during the rainy season. It is possible that this was connected with an unusually long dry spell between January 22nd and February 22nd, with not even a trace of rain from January 28th to February 6th.

Details of Presentation

Species in the list are numbered as in Mackworth Praed and Grant, 'Birds of Eastern and North Eastern Africa', Second Edition, 1957. Subspecies are not normally mentioned; no unusual ones were identified. The phrase 'generally common' means that one was never surprised to see the bird throughout the year in any typical habitat.

'Chidya' in the list means 'within the school boundary'. 'Near Chidya' means within a mile of this, sometimes much less. Msati is a very small settlement immediately outside the school boundary to the south-east. 'Mwiti bridge' refers to the small stretch of river-valley visible from the concrete bridge over the river just below Mwiti village, about 5 miles south-east of Chidya on the Chiwata-Majembe road. Nangoo and Nyangao are on the Masasi-Lindi road. Records ascribed to 'Rondo Plateau' were all seen from the road between Nyangao and St. Cyprian's Theological College, Ngala.

Just one more Bird

So many people connected with the school remarked that they had in previous years, apparently usually in December, seen the presumably unmistakable Pennant-wing Nightjar, Semelophorus vexillarius Gould, that I do not doubt that this also is a genuine Chidya bird.

The Birds.

ANHINGIDAE - Darters

28. Darter, Anhinga rufa (Lacépède & Daudin)
    One, Masasi dam, Sept. 14th.

ARDEIDAE - Herons and Egrets

33. Grey Heron, Ardea cinerea Linnaeus
    One, Ruvuma River near Luatala, Aug. 11th.
38. Yellow-billed Egret, Mesophoyx intermedius (Wagler)
    Small parties seen from Lindi-Masasi road, July 30th; Masasi dam, May 7th.

SCOPIDAE - Hammerkops

53. Hammerkop, Scopus umbretta (Gmelin)
    One occasionally, Chidya, October and November.

FALCONIDAE - Birds of Prey

129. Pygmy Falcon, Poliohierax semitorquatus (A. Smith)
    One near Chidya, Oct. 11th.
132. Kite, Milvus migrans (Boddaert)
    Common generally, but not noticed at Chidya between end of October and beginning of April. Single bird feeding in flight at c. 25 ft., off small bird held in talons, Oct. 26th.
154. Black-chested Harrier-Eagle, Circaetus pectoralis Smith
    One in flight, Chidya, Apr. 21st.
159. Bateleur, Terathopius ecaudatus (Daudin)
    Fairly common in ones and twos, but no records between Sept. 2nd and March 7th.

176. Shikra, Accipiter badius (Gmelin)
Common in February and March at Chidya; Masasi, May 7th. Bird in the hand, Feb. 26th., was clearly A.b. polyzonoides Smith.

177. African Goshawk, Accipiter tachiro (Daudin)
Common from early August to late October at Chidya.

185. Harrier-Hawk, Polyboroides typus Smith
One, Masasi, Oct. 12th; one, Chidya, April 21st.

PHASIANIDAE - Game Birds.

189-207 and 211-213: No species of Francolin or Quail were certainly identified. One or two small birds, thought to be Coqui Francolin, Francolinus coqui (Smith) or a Quail, not all of the same species, were frequently flushed from long grass on the Chidya hillside on dates between September and November 1963. A large species, thought to be the Scaly Francolin, Francolinus squamatus (Cassin) was once seen and frequently heard on Mtandi hill, Masasi, in May 1964.

208. Red-necked Spurfowl, Pternistis cranchii (Leach)
Shot ♀ in the hand, Chidya, Sept. 30th; three on road near Mwiti, Dec. 11th.

CHARADRIIDAE - Stilts.

296. Black-winged Stilt, Himantopus himantopus (Linnaeus)
One, Machole Salt Farm, near Lindi, July 30th.

SCOLOPACIDAE - Waders.

313. Green Sandpiper, Tringa ocrophus Linnaeus
One, Mwiti bridge, Dec. 11th.

COLUMBIDAE - Pigeons and Doves.

386. Red-eyed Dove, Streptopelia semitorquata (Rüppell)
Generally common.

388. Ring-necked Dove, Streptopelia capicola (Sundevall)
Generally common.

392. Laughing Dove, Stigmatopelia senegalensis (Linnaeus)
Common along main roads.

397. Emerald-spotted Wood-Dove, Turtur chalcospilos (Wagler)
Generally common.

401. Green Pigeon, Treron australis (Linnaeus)
One near Chidya, May 16th.

CUCULIDAE - Cuckoos and Coucals.

407. Black Cuckoo, Cuculus cafer Lichtenstein
A very vocal rainy season visitor, early December till at least the middle of March.

423. White-browed Coucal, Centropus superciliosus, Hemprich and Ehrenberg. Common; ubiquitous.

MUSOPHAGIDAE - Turacos.

425-437: Turacos were certainly seen on three occasions, though never specified with certainty. One at Chikundi near Ndanda on Nov. 1st and one at Chidya on Jan. 16th were thought to be Livingstone's or possibly Reichenow's Turaco, Tauraco livingstonii Gray, or Tauraco reichenowi (Fischer).

CORACIIDAE - Rollers.

460. Lilac-breasted Roller, Coracias caudata Linnaeus.
Lindi, May 23rd; Mtwara, July 18th.

463. Broad-billed Roller, Eurystomus glaucurus (Müller).
Several at and near Chidya, Nov. 3rd to Jan. 23rd; a rainy season visitor.

ALCEDINIDAE - Kingfishers

471. Pygmy Kingfisher, Ispidina picta (Boddaert)
Single birds at Chidya, Oct. 23rd, Nov. 10th, Nov. 30th, Dec. 10th.

476. Brown-hooded Kingfisher, Halcyon albiventris (Scopoli)
One, forest near Nyangao, Nov. 1st.

479. Striped Kingfisher, Halcyon chelicuti (Stanley)
One, Makonde Plateau, July 4th.

MEROPIDAE - Bee-eaters

488. Little Bee-eater, Melittophagus pusillus (Müller)
Three, once at Chidya, Aug. 29th; Masasi, May 8th; Lindi, May 23rd.

493. White-fronted Bee-eater, Melittophagus bullockoides (Smith)
One, Ruvuma River near Luatala, Aug. 11th; one, Nangoo, May 23rd.

496. Swallow-tailed Bee-eater, Dicrocercus hirundineus (Lichtenstein)
One, Rondo Plateau, Nov. 1st.

BUCEROTIDAE - Hornbills

497. Trumpeter Hornbill, Bycanistes bucinator (Temminck)
One, Rondo Plateau, Nov. 1st.

509. Crowned Hornbill, Tockus alboterminatus (Büttikorfer).
Generally fairly common, but not seen at Chidya nearer than Mwiti bridge, Dec. 11th.

515. Ground Hornbill, Bucorvus leadbeateri (Vigers).
One, Chidya, Dec. 1st; two, Chidya, Feb. 2nd.

PHOENICULIDAE - Wood-Hoopoes

Green Wood-hoopoe, Phoeniculus purpureus (Miller)
Generally common; always in small parties of up to eight. Party throwing down chunks of loose bark 1 ft. or more long, Chidya, Sept. 3rd. Party taking flies in Flycatcher style, Chidya, March 25th.

STRIGIDAE - Owls.

528 Barn Owl, Tyto alba (Scopoli).
Chidya, Nov. 16th.

533. African Wood-Owl, Ciccaba woodfordii (Smith).
Chidya, Dec. 7th and May 31st.

543. Spotted Eagle-Owl, Bubo africanus (Temminck).
Chidya, April 8th and 13th.

544. Verreaux's Eagle-Owl, Bubo lacteus (Temminck).
Chidya, June 11th; one openly perched in Flamboyant, Delonix regia discovered 3p.m. and undisturbed by extensive observation, though awake.

CAPRIMULGIDAE - Nightjars.

548 or 551. A nightjar thought to be either the Dusky, Caprimulgus pectoralis Cuvier or the Fiery-necked, Caprimulgus fervidus Sharpe was seen and observed closely at Chidya on September 24th and a mile or so away on June 26th. The bird, certainly larger than the Gaboon Nightjar, Caprimulgus fossii Hartlaub and generally of a warm brown, was not certainly distinguishable on plumage-details taken, but might be on behaviour (June 26th): Expert at dodging in and out among trees, a few feet above the ground. Continually does this (for a few yards only, when gently pursued) with only a slight whirr on take-off, and thereafter silent as it cunningly manoeuvres, changing direction before landing. Ground on this occasion either open with dead leaves, or with

long grass, or dead leaves, twigs etc., under fairly light trees. Almost invisible among dead leaves when facing openly at c. 15 ft.

560. Gaboon Nightjar, Caprimulgus fossii Hartlaub.
Single birds seen close and frequently at and near Chidya, especially on open grass path near buildings, and on sandy tracks, from Feb. 25th onwards. Two hawking flies, Chidya, June 8th.

COLIIDAE - Mousebirds.
566. Speckled Mousebird, Colius striatus Gmelin.
Two, Chidya, Oct. 9th only.

CAPITONIDAE - Barbets.
597. Golden-rumped Tinker-bird, Pogoniulus bilineatus (Sundevall)
One, Chidya, Sept. 23rd and Oct. 14th; often heard at this time of year.

PICIDAE - Woodpeckers.
623. Cardinal Woodpecker, Dendropicos fuscescens (Vieillot).
One near Chidya, Feb. 25th; Lindi, May 23rd.
629. Bearded Woodpecker, Thripias namaquus (Lichtenstein).
Two near Chidya, March 15th; pair mating, Chiwata, July 4th.

APODIDAE - Swifts.
644 White-rumped Swift, Apus caffer (Lichtenstein).
Common at Chidya all the year round, though less in evidence in January and February. Frequently in and out of African buildings from August onwards, often with nest on verandahs. Easterly movement of 100+ swifts overhead at Chidya on April 9th appeared to be of this species.

ALAUDIDAE - Larks.
654 - 689: No Larks were specified exactly, but the Family Alaudidae were represented by a tree-perching Lark with conspicuous white stripe over and behind eye, at Chidya, seen at least twice (Oct. 26th and Dec. 8th); and by two pairs in grass at Lindi airport and one pair at Mtwara airport (both July 18th) of a larger species - a plump, long-legged upstanding creamy-eyebrowed Lark of c. 6 ins., perhaps the Rufous-naped Lark, Mirafra africana A. Smith.

MOTACILLIDAE - Wagtails.
691. African Pied Wagtail, Motacilla aguimp Dumont
Often seen and heard at Chidya in August; full song, Aug. 31st.

MOTACILLIDAE - Pipits.
702 - 715. No Pipits were specified with certainty, but they were represented by an upstanding Pipit of longish and stoutish beak standing conspicuously on a rooftop in Masasi and thought to be the Long-billed Pipit, Anthus similis Jerdon.
716. Yellow-throated Long-claw, Macronyx croceus (Vieillot)
Lindi airport grass, Dec. 28th.

PYCNONOTIDAE - Bulbuls.
741. Black-capped Bulbul, Pycnonotus xanthopygos (Hemprich and Ehrenberg).
Ubiquitous and abundant, most of the year, though less in evidence during most of February and perhaps before this.

MUSCIDAPIDAE - Flycatchers.

778. Spotted Flycatcher, Muscicapa striata (Pallas)
One, Chidya, Dec. 9th, and March 25th; occasional.

799. South African Black Flycatcher, Melaenornis pammelaina (Stanley)
One, Chidya, Nov. 10th only.

809. Livingstone's Flycatcher, Erythrocercus livingstonei Gray
Chidya, one, Sept. 26th (seen clearly to be E. l. thomsoni Shelley.); two, March 14th.

815. Puff-back Flycatcher, Batis capensis Linnaeus
Masasi, May 5th.

817. Chin-spot Puff-back Flycatcher, Batis molitor (Hahn & Küster)
Chidya, June 9th. Batis Flycatchers fairly common round Chidya and Masasi; exact identifications of 815 and 817 refer only to two individuals.

823. Black-throated Wattle-eye, Platysteira peltata Sundevall
One male, Chidya, Sept. 10th only.

834. Grey-headed Paradise Flycatcher, Tchitrea plumbeiceps Reichenow
One, Chidya, Dec. 10th, frequently calling.

TURDIDAE - Thrushes, Chats, etc.

871. Red-tailed Chat, Cercomela familiaris (Stephens)
Masasi, one May 5th; at least four, May 8th.

876. Cliff-chat, Thamnolaea cinnamomeiventris (Lafresnaye)
Masasi: pair, Dec. 14th; several, both sexes, May 2nd, and 5th.

910. Red-backed Scrub-Robin, Erythropygia zambesiana Sharpe
Pair at Chidya, Dec. 7th, male in full song (and sometimes ventriloquial), seen displaying tail by waving slowly up and down, fully fanned.

SYLVIIDAE - Warblers.

979. Black-breasted Apalis, Apalis flavida (Strickland)
One, Chidya, Oct. 24th; two, Nov. 4th.

1009. Green-backed Camaroptera, Camaroptera brachyura (Vieillot)
One, Chidya, Dec. 7th and 10th.

SYLVIIDAE - Cisticolas or Grass Warblers.

1016 - 1044: Three types of Cisticola were distinguished at Chidya, though absolute certainty of species seemed impossible in the field. Call in addition to plumage features favoured Zitting Cisticola, Cisticola juncidis (Rafinesque) on Dec. 5th and Croaking Cisticola, Cisticola natelensis (Smith) on March 8th, May 11th and June 24th, as probable.

SYLVIIDAE - Prinias or Long-tails.

1045. Tawny-flanked Prinia, Prinia subflava (Gmelin)
Fairly common throughout the year.

HIRUNDINIDAE - Swallows.

1061. Wire-tailed Swallow, Hirundo smithii Leach
Common about houses at Chidya throughout the year, not decreasing during some of rains as White-rumped Swift and Striped Swallow. A pair built a nest at 12-15 ft. against concrete wall just below a corrugated iron roof above my door. This fell down twice, and was twice rebuilt, once in March. No young were at any time seen or heard; but by April 4th the two had been seen nightly on the nest for several weeks, and were recorded as still present on May 12th and June 14th (never recorded as missing between those dates.) On April 4th and June 14th I was 'attacked' by the presumed male sweeping very

fast and close towards my face, and only veering away just in time. The usual penetrating 'tweet' shrilly accompanied these attacks. Small broken egg-shell below nest, June 14th.

1063. Mosque Swallow, Hirundo senegalensis Linnaeus
Mtwara airport, Dec. 14th; small parties overhead at Chidya on various dates in April and May.

1065. Striped Swallow, Hirundo abyssinica Guérin
Abundant and vocal at Chidya often round houses in Aug., Sept., Oct.; few only Jan. and Feb.; none in March; occasional in April; common and vocal again by May 17th; abundant by June 24th. Breeding: family of four inside African house, Aug. 1st; beaks of two crammed with mud, Oct. 6th.

1077. Eastern Rough-wing Swallow, Psalidoprocne orientalis Reichenow
Quite common but rather irregular at and near Chidya. Written records only in August, May and June.

CAMPEPHAGIDAE - Cuckoo-Shrikes.

1081. Black Cuckoo-Shrike, Campephaga sulphurata (Lichtenstein)
Occasional at Chidya: one male, Aug. 31st, Nov. 17th, Nov. 24th; 2 females, Sept. 16th; pair Nov. 23rd. On these occasions they were not at all 'shy and inconspicuous', as described by Praed and Grant, II, p. 557.

DICRURIDAE - Drongos.

1088. Drongo, Dicrurus adsimilis (Bechstein)
Single birds at and near Chidya fairly common, probably throughout the year.

PRIONOPIDAE - Helmet-Shrikes.

1096. Chestnut-fronted Shrike, Sigmodus scopifrons Peters
Party of six, Chidya, August 6th only.

LANIIDAE - Shrikes.

1112. Red-backed Shrike, Lanius collurio Linnaeus
Single male near Chidya, April 8th.

1125. Tropical Boubou, Laniarius aethiopicus (Gmelin)
Generally common, but the bell-call of this and 1144, some of the most typical bird-sounds of Chidya, were hardly heard at all in January and February. Striking duet, Aug. 31st.

1128. Black-headed Puff-back, Dryoscopus cubla (Shaw)
Very common at Chidya: continually heard between August and April. Rump 'puffed', Nov. 8th only.

1133. Black-headed Bush-Shrike, Tchagra senegala (Linnaeus)
Generally common; either this bird or 1134 often seen from main roads.

1134. Brown-headed Bush-Shrike, Tchagra australis (Smith)
Generally common: see 1133. Full song first heard in late November.

1138. Sulphur-breasted Bush-Shrike, Chlorophoneus sulfureopectus (Lesson).
Much less in evidence at Chidya than all other shrikes except 1112, but I think present in small numbers throughout the year.

1144. Grey-headed Bush-Shrike, Malaconotus blanchoti Stephens
Very common at Chidya, though hardly seen or heard at all in Jan., Feb. and March. Its bell-call (seen being made) very characteristic of Chidya, though Praed and Grant seem only to refer this to 1125. Striking duet witnessed, Oct. 20th. Multiple chase with great variety of calls, Oct. 26th.

1148. Nicator, Nicator chloris (Valenciennes)
Extremely elusive but easily audible and I think common

throughout the year. Masasi once, Feb. 29th; intensive observation at Chidya from March to May. Always single bird, except for two calling to each other, May 17th. Great variety of calls. Has habit of keeping 'one tree ahead' of walker, very audible close at hand, but usually invisable.

ORIOLIDAE - Orioles.

1164. Golden Oriole, Oriolus oriolus (Linnaeus)
One male, Chidya, Dec. 7th; pair, Chidya March 8th and 14th.

1165. African Golden Oriole, Oriolus auratus Vieillot
Occasional in dry season; two, Chidya, Sept. 3rd (full song); one male May 16th.

1167. Black-headed Oriole, Oriolus larvatus Lichtenstein
Common and more visible at Chidya than 1164 or 1165; one Lindi, May 23rd.

CORVIDAE - Ravens and Crows.

1172. Pied Cow, Corvus albus Müller
Present throughout the year at Chidya in very varied numbers; almost absent in October and much of November, when they were replaced by Ravens as below. Numerous and noisy with bill-chattering and calling at Lulindi and Newala, Apr. 25th-27th. Two drinking blood at Masasi slaughter house, May 2nd.

1175. White-necked Raven, Corvultur albicollis (Latham)
Occasional throughout the year at Chidya, but much more numerous in October and November, occasionally in flocks of from ten to twenty.

STURNIDAE - Starlings.

1184. Violet-backed Starling, Cinnyricinclus leucogaster (Boddaert)
Quite common at Chidya in September and October: not seen at any other time. Not strongly gregarious: usually in ones and twos; seven, Oct. 29th.

1203. Red-winged Starling, Onychognathus morio (Linnaeus)
Common round Masasi; only one Chidya record, Aug. 4th.

ZOSTEROPIDAE - White-eyes.

1219. Yellow White-eye, Zosterops senegalensis Bonaparte
Quite common in small flocks for most of the year. Possibly more than one species present.

NECTARINIIDAE - Sunbirds.

1241. Little Purple-banded Sunbird, Cinnyris bifasciatus (Shaw)
Common at Chidya from end of September to end of November; apparently absent at other times. One Lindi, May 23rd.

1249. White-bellied Sunbird, Cinnyris talatala (Smith)
Masasi, Sept. 14th; May 1st and 7th.

1261. Amethyst Sunbird, Chalcomitra amethystina (Shaw)
Two in the hand at Chidya, March 7th. (juvenile male) and 17th (male).

1263. Scarlet-chested Sunbird, Chalcomitra senegalensis (Linnaeus)
Common, Masasi; not seen at Chidya save for juvenile in hand, March 7th.

1271. Collared Sunbird, Anthreptes collaris (Vieillot)
Masasi, May 5th and 7th.

PASSERIDAE and PLOCEIDAE - Sparrows, Weavers, Waxbills, etc.

1300. Grey-headed Sparrow, Passer griseus (Vieillot)
Generally common.

1312. Black-headed Weaver, Ploceus cucullatus (Müller)
Breeding colony, Masasi, Feb. 22nd. No weavers ever seen at Chidya.

1365. Black-winged Red Bishop, Euplectes hordeacea (Linnaeus)
One, Nangoo, May 23rd.

1367. Yellow Bishop, Euplectes capensis (Linnaeus)
One seen from Masasi-Newala road, March 19th.

1379. Bronze Mannikin, Spermestes cucullatus Swainson
Abundant in dry season, at Chidya; absent for at least the end of January and most of February.

1382. Magpie Mannikin, Amauresthes fringilloides (Lafreshaye)
One, Masasi, May 5th.

1406. Peters' Twin-spot, Hypargos niveoguttatus (Peters)
Pair at Chidya, Oct. 27th only.

1410. Green-winged Pytilia, Pytilia melba (Linnaeus)
Single birds at and near Chidya, quite often throughout the year.

1411. African Fire-finch, Lagonosticta rubricata (Lichtenstein)
Generally common throughout the year.

1418. Waxbill, Estrilda astrild (Linnaeus)
Occasional, Chidya, Feb.-April.

1430. Cordon-bleu, Uraeginthus angolensis (Linnaeus)
Generally common, but not recorded at Chidya between Nov. 24th and Apr. 9th.

1434 - 1440: Hyopchera spp. Indigo-birds, possibly of more than one species, were often seen on ground and on shrubs among houses at Lulindi on April 25th and 26th. Birds estimated at c. 4½", wholly dull black in plumage except for dull dark brown, only once seen clearly on wings and never on tail; no wash of either blue, purple or green distinguished on the general black; tail short; relatively large finch-type beak usually white, once pinker; legs apparently brown.

1441. Pin-tailed Whydah, Vidua macroura (Pallas)
Near Nangoo, Nov. 1st. Flock, both sexes at Kilwa airport, Dec. 14th; quite common in March at Chidya, but not otherwise recorded there; Lulindi, Apr. 25th.

1444. Paradise Whydah, Steganura paradisaea (Linnaeus)
Only once near Chidya, June 28th, immediately after seeing 1445 a few yards away. Several individuals seen from Masasi-Newala road, March 19th and Apr. 24th.

1445. Broad-tailed Paradise Whydah, Steganura orientalis (Heuglin)
Single males often seen near Chidya, usually at Msati, between May 17th and July 11th. Call recorded as a rattle, similar to but gentler than that of Mistle-Thrush (Turdus viscivorus); remarkable display with tail on three levels, July 11th. See J.E.Afr.Nat.Hist.Soc. Vol. XXV, No. 2, p.108, June 1965.

FRINGILLIDAE - Finches.

1148. Yellow-fronted Canary, Serinus mozambicus (Müller)
Small flocks regularly in Casuarina trees at Chidya, Sept., Oct. and Nov.

1456. Streaky-headed Seed-eater, Serinus gularis (Smith)
Not identified certainly till July 4th near Chiwata, but suspected to be generally common.

EMBERIZIDAE - Buntings.

1469. Golden-breasted Bunting, Emberiza flaviventris Stephen
Pair near Chidya, March 4th; one June 1st; probably not uncommon.

1476. Cinnamon-breasted Rock-Bunting, Fringillaria tahapisi A. Smith.
One at Chidya, June 23rd, only.

(Received for publication 8th August 1965)

KEYS TO THE GENERA OF INSECTIVORA, CHIROPTERA AND RODENTIA OF EAST AFRICA

By

J.B. FOSTER, Department of Zoology,
University College, Nairobi and

A. DUFF-MACKAY, National Museum, Nairobi.

It is the purpose of these keys to help newcomers to the field to become more rapidly acquainted with the small mammals of East Africa; a task which is usually found difficult due to the lack of comprehensive literature dealing with identification. The keys extend only to generic level since a taxonomic revision is needed in most groups. Having determined the genus more specialised works, of which the following will be found most useful, can be referred to for the species: for all orders; Allen (1) Ansell (2) Ellerman (9) Hollister (11) Moreau (12) Swynnerton & Hayman (14 and 15), for Chiroptera; Harrison (10), and for Petrodomus (elephant shrews), Corbet (6). References to original descriptions and old revisions may be found in the above.

Walker (16) has been used as the authority for some of the more problematical genera, while Romer (13) has been used at the higher taxonomic level (e.g. for the affinities of Anomalurus and Pedetes).

To use the keys it is generally necessary to have both the skin and skull for Chiroptera, and although the Insectivora and Rodentia can be keyed on the skull alone, skin characters are included. None of the keys can be used for the skin alone.

This work has been carried out at the National Museum using mainly the National Museum collection of small mammals.

Key to the Insectivores. 13 genera

Zygomatic arch present, (golden moles, hedgehogs, and elephant shrews).. 1
Zygomatic arch absent, (shrews and otter shrews).............. 6

1. Cheek teeth zalambdodont (cusps V-shaped); body mole-like, with a smooth leathery pad on the nose, and very large claws on the front feet; rudimentary eyes covered with skin; no externally visible ears or tail, (family Chrysochloridae).................................. Amblysomus (= Chlorotalpa)
   Cheek teeth dilambdodont (cusps W-shaped; body not mole-like 2

2. Palate extends well beyond the tooth row; body heavily armed with spines; nose not long and mobile, (family Erinaceidae) .... Erinaceus
Palate does not extend beyond the tooth row; body not armed with spines; nose long and mobile, projecting far beyond the nasal bones, (family Macroscelididae) 3

3. *Seven or eight teeth in the upper jaw; no large palatal foramina; skull more than 57 mm long. Pelage coarse, black and red or checkered .... Rhynchocyon
Ten teeth in the upper jaw; large palatal foramina present; skull less than 57 mm long. Pelage soft, light grey-brown 4

4. A pair of large palatal foramina lie between the molariform teeth. Ears shorter than 30 mm; five toes on the hind foot 5
No large palatal foramina between the molariform teeth. Ears longer than 30 mm; four toes on the hind foot .... Petrodomus

5. Ten teeth in the lower jaw. Chest gland present on the skin .... Elephantulus
Eleven teeth in the lower jaw. Chest gland present (N. fuscipes) or absent (N. brachyrhynchus) Nasilio

6. Ten upper and ten lower teeth (zalambdodont or dilambdodont). Nose not long and mobile; body adapted for swimming, with a long and, at least to some extent, laterally compressed tail, (family Potamogalidae) 7
Not more than nine upper and seven lower teeth (dilambdodont). Nose long and mobile, projecting far beyond the nasal bones; body not adapted for swimming, (family Soricidae)................................ 8

7. Teeth zalambdodont. Tail much compressed laterally; nose with a horny or leathery rhinarium; hind feet not webbed .... Potamogale
Teeth dilambdodont. Tail slightly compressed laterally; nose with a fleshy rhinarium; hind feet webbed .... Micropotamogale

8. Nine teeth in the upper jaw (four upper unicuspids)............ 9
Eight teeth in the upper jaw (three upper unicuspids) 11

9. Seven teeth in the lower jaw; braincase strongly angled in the squamosal region. No bristle hairs on the tail .... Myosorex
Six teeth in the lower jaw; braincase not strongly angled laterally. With or without bristle hairs on the tail 10

* In very old individuals the crowns of two rooted teeth may be so worn as to be completely divided, thus appearing as two separate teeth.

10. Condylo - basal length of the skull well over 20 mm. Length of the head and body 120 to 150 mm; possesses a remarkably strong, thick, vertebral column; no bristle hairs on the tail .... Scutisorex
Condylo - basal length less than 20 mm. Head and body length well under 100 mm; vertebrae not specialized as above; tail with bristle hairs, or (formerly genus Sylvisorex)without bristle hairs on the tail............................. Suncus

11. Six or seven teeth in the lower jaw; braincase strongly angled laterally in the squamosal region. Body rather mole-like; with long claws, particularly on the front feet; ear not visible above the fur; tail short, about twice the length of the hind foot, without bristle hairs .... Surdisorex
Six teeth in the lower jaw; braincase not strongly angled laterally. Habit shrew-like; tail more than three times the length of the hind foot, with bristle hairs .... Crocidura

Key to the Chiroptera 29 genera

Special attention should be paid to counting teeth in bats; some teeth are minute and must be looked for with great care. External features readily characterize the families of bats, and these are illustrated in Fig. 1.

Crowns of the molars smooth, with a longitudinal groove. The first and second fingers with a claw; eyes large, (suborder Megachiroptera, family Pteropodidae)...1
Crowns of the molars not smooth. Only the first finger with a claw; eyes small or minute, (suborder Microchiroptera)....................................6

1. *Cheek teeth 3/5. White tufts of fur by the ears 2
Cheek teeth 5/6. No white tufts of fur by the ears........... 4

2. Rostrum large, laterally compressed and rectangular in profile. Lips with a large flap .... Hypsignathus
Not as above 3

3. Orbit to the tip of the nasals more than the lacrymal breadth .... Epomophorus
Orbit to the tip of the nasals less than the lacrymal breadth .... Micropteropus

4. First upper cheek tooth minute. Head and shoulders paler than the body .... Pteropus
Not as above 5

* (i.e. 3 upper and 5 lower cheek teeth)

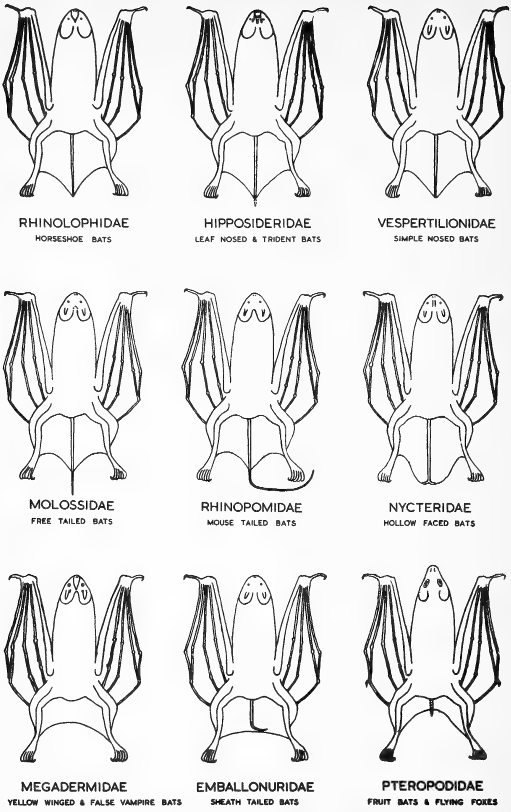

RHINOLOPHIDAE
HORSESHOE BATS
HIPPOSIDERIDAE
LEAF NOSED & TRIDENT BATS
VESPERTILIONIDAE
SIMPLE NOSED BATS
MOLOSSIDAE
FREE TAILED BATS
RHINOPOMIDAE
MOUSE TAILED BATS
NYCTERIDAE
HOLLOW FACED BATS
MEGADERMIDAE
YELLOW WINGED & FALSE VAMPIRE BATS
EMBALLONURIDAE
SHEATH TAILED BATS
PTEROPODIDAE
FRUIT BATS & FLYING FOXES

Fig. 1

5. Bulla with an auditory meatus. Body and femur covered with yellowish fur .... _Eidolon_
Bulla without an auditory meatus. No yellowish fur .... _Rousettus_

6. Two inflated bulbs on top of the rostrum. Free tail, about as long as the head and body, (family _Rhinopomatidae_)............................ _Rhinopoma_
No bulbs on top of the rostrum. Tail shorter than the head and body 7

7. Tail perforates the upper surface of the interfemoral membrane, (family _Emballonuridae_).............. 8
Tail does not perforate the interfemoral membrane 9

8. Three lower incisors; frontals concave. Forearm 45 to 55 mm long .... _Coleura_
Two lower incisors; frontals not conspicuously concave. Forearm 50 to 83 mm long .... _Taphozous_

9. Dish face depression on the rostrum. Tail ends in a T-shaped tip, (family _Nycteridae_) .... _Nycteris_
Tail does not end in a T-shaped tip 10

10. Dental formula 0/2, 1/1, 1/2, 3/3. Tailless; tragus divided, (family _Megadermidae_) 11
Bats with tails; tragus, if present, not divided 12

11. Palate extends anteriorly slightly beyond the nasals. Overall colour grey; nose leaf does not extend half way to the base of the ears .... _Megaderma_ (= _Cardioderma_)
Palate extends anteriorly well beyond the nasals. Wings yellowish in life; nose leaf extends more than half way to the base of the ears .... _Lavia_

12. No tragus present 13
Tragus present, may be small 17

13. Dental formula 1/2, 1/1, 2/3, 3/3. Leaf nosed; Two joints in the first toe, three in the others, (family _Rhinolophidae_) .... _Rhinolophus_
Dental formula 1/2, 1/1, 1-2/2, 3/3; zygoma large. Leaf nosed; two joints on all the toes, (family _Hipposideridae_).............................. 14

14. Cheek teeth 5/5. Nasal structure may or may not have three pointed flaps above 15
Cheek teeth 4/5. Nasal structure horseshoe-shaped with three pointed flaps above 16

15. Nasal structure squarish .... _Hipposideros_
Nasal structure horseshoe shaped with three pointed flaps above; ear notched .... _Triaenops_

16. Ears very short, hardly projecting above the fur ...... _Cloeotis_
Ears large, naked... _Asellia_

17. Braincase thick, flat, broad. Tail projects beyond the edge of the interfemoral membrane; fur short, velvet-like, (family Molossidae)................ 18
Braincase generally delicate, round. Tail extends only to the edge of the interfemoral membrane; hair often long, silky, (family Vespertilionidae).. 20

18. Skull height 1/3 of the width .... Platymops
Skull height at least 1/2 of the width 19

19. Flange on the zygomatic arch large. A pale greyish area on the upper back .... Otomops
Flange on the zygomatic arch indistinct. Generally uniform colour, sometimes spotted with white .... Tadarida

(= Nyctinomus, and including subgenera Chaerophon and Mops)

20. Two upper incisors. Ear more than 15 mm long .... Laephotis
Ear less than 15 mm long 21

21. Cheek teeth 6/6 22
Cheek teeth less than 6/6 23

22. First two upper cheek teeth small. Fur long and woolly; ear rather large, pointed and funnel-shaped; margin of the interfemoral membrane fringed with hair .... Kerivoula
Second upper cheek tooth minute. Fur not long and wooly; tragus erect and tapering .... Myotis

23. Cheek teeth 5/6, the first upper being minute. In the longest finger (3rd.) the second bone from the"wrist" is about 1/3 the length of the third bone; tail long, about the length of the head and body .... Miniopterus
Cheek teeth less than 5/6. In the 3rd. finger the second bone from the "wrist" is well over 1/3 the length of the third bone 24

24. Cheek teeth 5/5. Generally very small species..... Pipistrellus
Cheek teeth 4/5 25

25. Condylo-basal length of skull less than 16 mm................ 26
Condylo-basal length more than 16 mm. Usually lemon-yellow or cream coloured fur below .... Scotophilus

26. One upper incisor .... Nycticeius
Two upper incisors 27

27. Braincase very deep. A fleshy lobe at the base of the mouth connected by a ridge to the base of the ear .... Glauconycteris
Not as above.. Eptesicus

ERRATUM to J.E. Afr. Nat. Hist. Soc., Vol.XXV, No3 (112)
Jan 1966, p.194.

Key to Genera of Chiroptera: No. 20 should read:

20. Two upper incisors, cheek teeth less than 6/6.
Ear more than 15mm long .... Laephotis
Ear less than 15mm long, or else one upper incisor or cheek teeth 6/6 .... 21.

Key to the Rodents — 46 Genera

The key is based on skull characters. Skin characters given for each genus are seldom key characters and are intended to be used mainly as a measure of confirmation of an identification already arrived at by using the skull. The skin characters are short and sometimes, perhaps, a little vague; this is due to the necessity for brevity and to include the genus in all its forms through out East Africa.

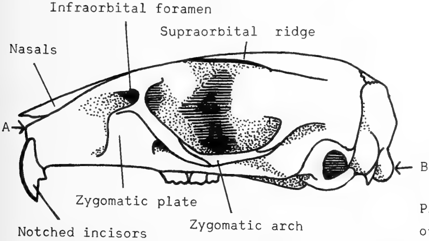
Unless it is specifically stated, the lower jaw is not used in the key, and the fur colours given are the general overall colours of the back and sides. For the sake of simplicity, M is loosely used for all molariform teeth.

The animals are divided into size groups as follows:- "Very large" - any size greater than Rattus rattus; "Large" - size about that of Rattus rattus; "Medium" - size about that of Rattus (Mastomys) coucha; "Small" - the size of Mus musculus or smaller.

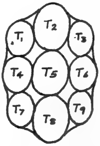
In the case of the Muridae a well haired tail means well haired for a Murid, and would be very poorly haired when compared with, for instance, a squirrel or a dormouse (Graphiurus). A common example of a well haired tail is that of Arvicanthis, and a poorly haired tail that of Rattus rattus. A pencilled tail is one which becomes very narrow and well haired towards the tip, a common example is Grammomys.

It has been found inconvenient to key the Murids according to their subfamilies, of which there are three:- Dendromyinae, Murinae and Otomyinae. There is, furthermore, some disagreement as to the classification of some genera. Delanymys, Dendromus, Deomys, and Steatomys, with the possible inclusion of Beamys and Saccostomus, are Dendromyinae, Otomys belongs to the Otomyinae, and the rest are all Murinae.

In the case of the genus Rattus a departure has been made from the general plan, so that the five subgenera, all of which have formerly held full generic status, have been keyed out separately.



AB = Condylo-basal length



Plan of the cusps of the first upper left molar (M_1) of a Murid

Fig. 2

Infraorbital foramen small, rarely as large as the surface of the largest molar, or else absent, (suborder Sciuromorpha : some mole-rats and all squirrels 1
Infraorbital foramen present, larger in one dimension than the surface of the largest molar 8

1. Angular portion of the lower jaw turned outwards; incisors white. Fossorial; tail short, (superfamily Bathyergoidea, family Bathyergidae).. 2
No outward turn to the lower jaw; incisors yellow; generally arboreal; tail long and bushy, (superfamily Sciuroidea, family Sciuridae)........... 4

2. Cheek teeth 3/3 or 2/2. Size medium; body naked...Heterocephalus
Cheek teeth more than 3/3. Size large; body furred 3

3. Cheek teeth always 4/4; palate extends well beyond the tooth row, as far as, or beyond, the roots of the upper incisors. Fur grey-brown, and usually with a white patch on top of the head....... Cryptomys
Cheek teeth 6/6, though usually no more than 5/4 present at one time, often 4/4; palate does not extend far beyond the tooth row, never reaching the roots of the upper incisors. Fur light grey-brown with no white patch on head..... Heliophobius

4. Palate extends well beyond the tooth row. Size large to very large; fur bristly .... Xerus
(including subgenus Euxerus)
Palate does not extend conspicuously beyond the tooth row. Fur soft 5

5. Infraorbital foramen egg-shaped, about the size of the surface of the largest cheek tooth. Cheek teeth 4/4. Size very large; ventral surface poorly furred, sharply divided from the well furred sides and back .... Protoxerus
Infraorbital foramen smaller than the surface of the largest cheek tooth. Ventral surface with less fur than the sides, but there is no sharp division 6

6. Cheek teeth 4/4. Size very large, (including subgenus Aethosciurus).......................... Heliosciurus
Cheek teeth 5/4. Size medium to large 7

7. Both upper and lower Cheek teeth flat crowned in the adult. Four mammae, small round ears...... Funisciurus
Lower cheek teeth tend to remain cuspidate in the adult. Six mammae, ears not unusually small .... Paraxerus
(including subgenus Tamiscus)

8. Infraorbital foramen generally V-shaped, (suborder Myomorpha: most rats and mice)....................13

Infraorbital foramen large, oval or round, usually larger than the foramen magnum; four cheek teeth. Size always very large, (suborder Hystricomorpha) 9

9. Volant or saltatorial. Fur soft, (superfamily Anomaluroidea) 10
Cursorial. Fur bristly or spiny, (superfamily Hystricoidea) 11

10. Infraorbital foramen slightly smaller than the foramen magnum. Volant adaptations, with a membrane between the limbs; sharp scales present at the base of the tail, (family Anomaluridae) .... Anomalurus
Infraorbital foramen larger than the foramen magnum. Saltatorial, with long hind legs and tail; no scales at the base of the tail, (family Peditidae) .... Pedetes

11. Upper incisors with 3 grooves. Fur bristly, (family Thryonomidae) .... Thryonomys (= Choeromys)
Upper incisors not grooved. Pelage spiny, with long, hollow quills, (family Hystricidae) 12

12. Top of the skull flat. Tail about as long as the head and body .... Atherurus
Top of the skull very convex. Tail short .... Hystrix

13. Temporal muscles cover the cranium, and are divided by a sagital crest in mature individuals; cheek teeth 3/3; incisors yellow. Size large; fossorial adaptations, lips joined behind the upper incisors; tail short, (family Rhizomyidae) .... Tachyoryctes
Temporal muscles originate only on the sides of the cranium, no sagital crest. Lips not joined behind the upper incisors 14

14. Cheek teeth 4/4. Size small-medium; fur short, soft and dense, light grey or grey-brown in colour; tail thick and bushy, (family Gliridae)... Graphiurus
Cheek teeth 3/3. Tail, except for Lophiomys, relatively sparsely haired, never bushy 15

15. Cheek teeth either laminate, with laminae separated by wide folds, or cuspidate with cusps in 2 rows, (family Cricetidae) 16
Cheek teeth, if laminate, with laminae tightly pressed together; usually cuspidate with cusps in 3 rows, (family Muridae) 19

16. Temporal fossae roofed over by plates of bone arising from the frontals, parietals, and jugals; upper surface of the skull granulated; incisors ungrooved, white. Size very large; hair long with a black and white erectile crest on the back; tail short and bushy, (subfamily Lophiomyinae) .... Lophiomys

Temporal fossae open; upper surface of the skull not granulated; upper incisors grooved, yellow. Size small to large; fur short and generally golden brown in colour; tail long and well haired or tufted at the tip, (subfamily Cricetinae) 17

17. Zygomatic plate projects less than half way from the posterior edge of the infraorbital foramen to the incisors. Size small, hind foot generally less than 24 mm long, with soles naked, subgenus Dipodillus, or completely haired, subgenus Gerbillus .... Gerbillus
Zygomatic plate projects about half way from the posterior edge of the infraorbital foramen to the incisors. Size medium to large: hind foot generally more than 24 mm long... 18

18. Second pair of palatal foramina shorter than the length of M_1. Size large, generally weighing over 75 gms.; hind foot usually more than 35 mm long with the sole entirely naked .... Tatera
Second pair of palatal foramina longer than the length of M_1. Size medium, generally weighing less than 75 gms.; hind foot usually less than 35 mm long with a narrow band of fine hairs across the sole .... Taterillus

19. Incisors not grooved 20
Incisors grooved 44

20. Condylo-basal length of the skull more than 50 mm.; palatal foramina shorter than, and not nearly reaching, the tooth row. Size very large; fur short, fine and grey-brown in colour; tail about equal in length to the head and body, fairly well haired, dark in colour for at least 3 or 4 inches from the base, changing abruptly to white distally; possesses cheek pouches .... Cricetomys
Condylo-basal length of the skull less than 50 mm........... 21

21. Palate ends far behind M_3, the end acute, V-shaped.. 22
Palate does not end far behind M_3, the end rounded or square 23

22. Incisors outstandingly pro-odont. Size medium; fur coarse, brown; tail very much shorter than the head and body and fairly well haired ...... Uranomys
Incisors orthodont. Size small - medium; fur spiny, varying in colour from light red-brown to dark grey, belly white; tail slightly shorter than the head and body, bicoloured .... Acomys

23. M_1 relatively large, larger than M_2+ M_3; the wearing surfaces of the upper incisors notched. Size small; fur fine, though sometimes "crisp", grey-brown in colour, belly sometimes white; tail shorter than head and body .... Mus
M_1 not longer than M_2+M_3, the wearing surfaces of the upper incisors seldom notched 24

24. Condylo-basal length of the skull less than 20 mm. Size small; fur soft, brown, with a black patch between the eye and the nostril; tail much longer than the head and body, poorly haired .... Delanymys
Condylo-basal length more than 20 mm..........................25

25. Palatal foramina short, not nearly reaching M_1................26
Palatal foramina end about level with, or posterior to, M_1 27

26. Rostrum flat in profile; zygomatic arch with a small flange. Size large; fur soft, brown; tail slightly longer than the head and body, poorly haired .... Malacomys
Rostrum convex in profile; zygomatic arch with no flange. Size medium; fur short, soft, uniform light grey; tail slightly shorter than the head and body, very finely haired, grey at the base, white distally; possesses cheek pouches .... Beamys

27. Frontals perfectly flat in the young, and generally concave in the adults. Size large; fur soft, brown, with a dark patch extending from the nose backwards to surround the eyes, belly white; tail longer than the head and body, pencilled .... Thallomys
Frontals at least slightly convex, or convex in parts 28

28. Molars massive, M_3 as long as M_2 29
M_3 shorter than M_2 30

29. Width across both palatal foramina less than the width of M_1; cusps normal. Size large; fur long and soft, brown; tail about equal in length to the head and body, poorly haired............ Dasymys
Width across both palatal foramina greater than the width of M_1; cusps large and of uniform size, with the wearing surfaces strongly directed backwards in the upper jaw; the outer row of cusps of M_3 very conspicuously reduced. Size large, fur long and soft, grey-brown with a deep rufous nose, ears, and rump; belly white; tail longer than the head and body, poorly haired .... Oenomys

30. Incisors narrow, markedly pro-odont; palate and palatal foramina wide; no supraorbital ridge. Size medium; fur soft, short, grey-brown; tail shorter than the head and body, finely haired ...... Zelotomys
Incisors not pro-odont 31

31. Distance from the anterior edge of the zygomatic plate to the tip of the nasals less than 1½ times the length of the tooth row, measuring along the crowns 32
Distance from the anterior edge of the zygomatic plate to the tip of the nasals more than 1½ times the length of the tooth row, measuring along the crowns 34

32. Width of the rostrum immediately in front of the zygomatic plate equal to, or greater than, the length of the rostrum (measured from the zygomatic plate), and about equal to the length of the tooth row; no black membrane covering the skull. Size medium-large; fur short, coarse, yellowish-brown to light grey, flecked with black; tail shorter than the head and body, well haired, bicoloured .... Arvicanthis
Width of the rostrum less than its length (from the zygomatic plate); a thin black membrane covers the surface of the skull (this easily removed) 33

33. Zygomatic plate generally sharp pointed anteriorly. Size medium; fur short, coarse; general colour either dark brown with a black dorsal stripe and numerous longitudinal white stripes (L. barbarus) or broken stripes (L. striatus) on the back and sides, or else light orange-brown with a single black dorsal stripe (L. griselda); tail about equal in length to the head and body, well haired, bicoloured .... Lemniscomys
Zygomatic plate rarely sharp pointed anteriorly. Size medium; fur short, coarse, grey-brown in general colour, with 4 dark longitudinal dorsal stripes; tail shorter than the head and body, well haired, bicoloured .... Rhabdomys

34. Anterior ventral edge of the foramen enclosed by the zygomatic arch is level with, or posterior to, the anterior edge of M_1; no supraorbital ridge. Size medium to large; fur short, coarse (or "harsh") with the colour varying from dark grey to deep red-brown; tail shorter than the head and body, poorly haired .... Lophuromys
Anterior ventral edge of the zygomatic foramen lies anterior to M_1 35

35. Anterior edge of the zygomatic plate turned outwards; zygomatic arch greatly flattened and deflected inwards ventrally; antero-internal cusp (T_1) of M_1 and M_2 absent, postero-internal cusp (T_7) present. Size medium - large; fur short, soft, brown; tail very short, well haired; possesses cheek pouches .... Saccostomus
Zygomatic plate not turned outwards; zygomatic arch not greatly flattened; T_1 present 36

36. T_7 of M_1 and M_2 well developed, so that there are 3 well defined cusps on the inner side of M_1 and M_2. Size medium-large; fur soft, short, grey-brown; tail much longer than the head and body, pencilled .... Thamnomys
T_7 of M_1 and M_2 absent, or else so much reduced that there are only 2 well defined cusps on the inner side of M_1 and M_2 37

37. Supraorbital ridge absent; in profile the top of the rostrum is in a straight line with the top of the cranium. Size medium - large; fur short, soft, and thick, with numerous guard hairs on the back and belly; deep brown in colour; tail longer than the head and body, poorly haired; hind foot very long, the metatarsals loosely knit together so that the foot can be greatly expanded in width .... Colomys
Supraorbital ridge present; rostrum curved downwards. Hind foot normal 38

38. Outer borders of the palatal foramina strongly angled outwards. Size medium; fur short, soft, red-brown (redder on the rump) with a dark dorsal stripe; tail slightly shorter than the head and body, poorly haired .... Hybomys
Outer borders of the palatal foramina straight or smoothly curved. Fur with no dorsal stripe 39

39. Distance from the anterior end of the palatal foramina to the incisors greater than the length of M_1 ; supraorbital ridge prominent. Size large; fur very short, slightly coarse, and with long guard hairs; colour ranging from light brown to dark grey; tail about the same length as the head and body, poorly haired; D_5 of the hind foot extends well beyond the base of D_4. Rattus (Rattus)
Distance from the anterior end of the palatal foramina to the incisors less than the length of M_1 ; or else about equal to the length of M_1, in which case the animal is medium sized, or smaller 40

40. Distance from the palatal foramina to the incisors less than the length of M_1. Size large or medium 41
Distance from the palatal foramina to the incisors about equal to the length of M_1. Size small - medium or medium 42

41. Zygomatic plate small, extends only very slightly anterior to the zygomatic arch; supraorbital ridge not very prominent. Size medium; fur short, soft, from light grey to red-brown in colour; tail longer than the head and body, pencilled; D_5 of the hind foot reaches first joint of D_4 .... Grammomys
Zygomatic plate extends well in front of the zygomatic arch; supraorbital ridge very prominent. Size large; fur short; soft but not silky, with guard hairs; tail about the

same length as the head and body; D_5 of the hind foot does not reach the base of D_4 .... R. (Aethomys)

42. Zygomatic plate small; extends only very slightly anterior to the zygomatic arch. Size small-medium; fur soft, brown to grey-brown with, usually, a darker patch surrounding the eye; tail longer than the head and body, finely haired; D_5 of the hind foot extends well beyond the first joint of D_4 .... R. (Hylomyscus)

Zygomatic plate extends well in front of the zygomatic arch (at least 1 mm). D_5 of the hind foot does not reach the first joint of D_4 43

43. Septum dividing the palatal foramina swollen only in the anterior half, the foramina extend posteriorly to at least the second root of M_1. Size medium; fur short, soft, grey-brown; tail about the same length as the head and body, poorly haired; D_5 of the hind foot reaches, but does not extend beyond, the base of D_4 .... R. (Mastomys)

Swelling in the septum dividing the palatal foramina extends beyond the anterior half, the foramina do not reach the second root of M_1. Size medium; fur short, soft, grey-brown; tail longer than the head and body, poorly haired; D_5 of the hind foot extends a little beyond the base of D_4.................... R. (Praomys)

44. Both upper and lower incisors grooved; molars laminate; in the upper jaw M_3 is the largest cheek tooth. Size large; fur long, soft, deep brown flecked with grey-black; tail much shorter than the head and body, well haired............ Otomys

Only the upper incisors grooved; cheek teeth cuspidate, M_3 being the smallest 45

45. Upper incisors with 2 grooves; no zygomatic plate. Size large; fur short, slightly coarse, red-brown on the back and white on the belly, tail longer than the head and body, pencilled, bicoloured .... Deomys

Upper incisors with only one groove; at least a small zygomatic plate present 46

46. Antero-internal cusp (T_1) of M_1 and M_2 absent. Size small 47

T_1 of M_2 and M_3 present. Size medium-large or large 48

47. Tooth rows parallel to each other. Fur soft; light brown with a dark dorsal stripe; tail slightly longer than the head and body, finely haired; only 3 functional digits on the front feet .... Dendromus

Tooth rows diverge anteriorly. Fur short, soft, grey to red-brown in colour with the belly white; tail shorter than the head and body, well, but finely, haired; 4 functional digits on the front foot .... Steatomys

48\. Palatal foramina project beyond the anterior edge of M_1. Size large; fur long and coarse, orange-brown flecked with black; tail slightly longer than the head and body, well haired with hairs up to 4 mm. long, bicoloured....... Mylomys

Palatal foramina do not reach M_1. Size medium-large; fur rather long, coarse, light brown flecked with black, and often with a dark dorsal stripe; tail about the same length as the head and body, well haired, but the hairs less than 4 mm long, bicoloured .... Pelomys

Acknowledgements

Grateful acknowledgement is extended to Dr. G.B. Corbet of the British Museum (Nat.Hist.) for the loan of some material, and to Messrs. J.G. Williams, J.R. Wyman, M. Modha, I. Furtado and A. Menzes for help in checking the keys.

Dr. J.B. Foster expresses his gratitude to the Canadian Government who have financed his appointment at the University College.

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(Received for publication 24th. November 1965)

THE HABITAT OF THE ROCK HYRAX

By

J.B. SALE
(Zoology Department, University College, Nairobi)

Introduction

There are three genera of hyrax and two of these, Procavia and Heterohyrax, are rock hyraces, living in existing cavities in rocky outcrops. Procavia is the larger of the two and is distributed throughout Africa and the Middle East while Heterohyrax is found down the eastern coast of Africa (Sale, 1960). Both genera are gregarious, living in colonies among the rocks and in this respect differ from the solitary tree hyrax, Dendrohyrax, which, unlike the rock hyraces, is strictly nocturnal. Procavia and Heterohyrax in East Africa show no basic differences in behaviour and selection of habitat as far as "lowland" areas are concerned. Only the rather specialised P. Johnstoni mackinderi Thomas inhabits the cold alpine zone of Mount Kenya, however. The tendency of some workers to refer to Heterohyrax as the "bush" hyrax (e.g. Roche, 1962) and accord it an intermediate position, as far as habitat selection is concerned, between Dendrohyrax and Procavia seems to me to be unjustified. Heterohyrax is just as much a rock dweller as Procavia and it is significant that while there are separate native names for tree and rock hyraces, no distinction is made between the two genera.

In all social animals, the structure of the group depends to a large extent on the nature of the habitat and may have to be modified from time to time to fit in with changes in the habitat. If the animal is one which, like many rodents, modifies the habitat to suit its own social needs then a more rigid social structure can be maintained and will be modified only to a minor extent by such factors as terrain, soil type, predominant vegetation and climate. King (1959) says of the prairie dog, Cynomys sp. "By building towns that occupy acres and even square miles, prairie dogs modify their environment and make it more suitable to their needs", and similar statements could be made about many burrowing social rodents. The rock hyrax, however, is not a burrower and, as Bruce (1790) points out, the fleshy part of the toes projects beyond the nails precluding their use in digging. Occasionally one finds evidence of the hyrax having scratched out a small quantity of loose soil in order to enlarge a cavity or widen its entrance but even such minor modification of the environment as this is uncommon and certainly does not confirm Powell's statement (quoted in Shortridge, 1934) that they "do a considerable amount of digging".

The importance of suitable shelter to the distribution of the rock hyrax will be discussed more fully later but it can be stated here that wherever there are rocky cliffs, outcrops or boulder screes providing cavities in which the colonies can shelter, one can reasonably expect to find hyrax (Drake-Brockman 1910; Shortridge, 1934). Within this basic requirement it is difficult to define a "typical" hyrax habitat in terms of environmental necessities, although where colonies exist there are certain visible indications of their presence

such as urine deposits on the rocks (see Plate 1 a).

Geology

Throughout the highlands of Abyssinia and East Africa comparatively recent volcanic activity and faulting have resulted in the presence of frequent outcrops of igneous rock. Very many of these outcrops occur along fault scarps where the weathering of the scree has left a loose collection of boulders at the foot of the cliff (see Fig. 1A). These boulder heaps, with large interstices, constitute an ideal habitat for hyrax colonies. Outcrops formed in this way are common throughout the highlands and particularly in the region of the Rift Valley where, in addition to the great walls of the valley itself, there are numerous secondary rifts in the valley floor. In the region of volcanoes, outcrops often represent the front of a lava flow that has had the slag removed by erosion, leaving boulders of volcanic rock (see Fig. 1B). In the large glaciated valleys radiating from the peaks of Mount Kenya similar collections of boulders have resulted from the weathering of lateral and terminal moraines (see Fig. 1C and Plate 1b).

Hyrax colonies are not confined to boulder screes, however, and frequently occupy cracks and crevices that have formed in exposed rock faces due to cooling and erosion. In some places, such as Lukenya Hill in the Ukambani area east of Nairobi, large vertical cracks have resulted in the distal portion of rock falling away and coming to rest as a massive boulder on the slope below (Fig. 2). Where this has happened a shear vertical rock face is left behind in the form of a cliff. Further erosion by wind and water has made horizontal cavities at the base of such cliffs by the removal of soil. These miniature caves form ideal hyrax shelters and are often connected to other similar cavities by horizontal ledges. If the boulder has not rolled far down the slope, its flat upper face forms an ideal basking surface near to the hole (Fig. 2). Any kind of rock may form a suitable habitat as long as it provides shelter and outside the highlands particularly, hyrax are frequently found inhabiting metamorphic Basement System rocks and occasionally sedimentary rocks, such as sandstone.

There are several accounts in the literature of hyrax living in the disused holes of other animals (Roberts, 1951). Thomas (1946) describes how one population of P. capensis Pallas in South Africa increased greatly following the destruction of wild predators (especially jackal) by local sheep farmers. The result was over-population of the rocky habitat, forcing the hyrax onto the plains where they lived in the holes of the antbear, Orycteropus afer Grote, and Meercat, Suricata suricatta Schreber. They also took refuge in road culverts, holes in stone walls and any other available shelter. It is thus apparent that hyrax are adaptable in the matter of the type of substrate in which they will occupy holes. Although hard rocks are most commonly used, holes in softer rock and even soil are inhabited in some areas.

The colony site

It is also difficult to establish definite rules about the size or extent of holes required. Floor space would seem to be the critical factor in hole size, as many holes are merely horizontal crevices no deeper than an adult hyrax in the crouching position (14 cm. for Procavia and 11 cm. for Heterohyrax). In fact, holes with a high ceiling are generally not used as living quarters. Providing there

are several holes large enough to house a family group of about five adult hyrax (about 1 m^2 of floor space), then there is the possibility of a small colony becoming established there. It is extremely rare to find a group living in a single isolated hole or crevice. In boulder screes, of course, there is usually an entire ramifying system of interstices comprising large cavities interlinked by smaller holes and cracks. In weathered rock faces, however, there are often large individual holes or crevices separated by a considerable distance from other cavities. Unless a cavity has similar shelter within about 10m. it will not be used as living quarters by hyrax, although they may take temporary refuge in it during flight from an enemy.

Well worn paths among the rocks or along ledges serve to link together holes that have no internal connection. Such paths are mainly horizontally disposed and often a number of them, at approximately the same level on the cliff, are linked together forming horizontal trunk paths which may extend along the entire length of a cliff or ridge (Fig. 4). Occasionally a vertical minor path links together the horizontal ones. Vertically arranged paths also lead directly from the holes to the main feeding areas which are generally above or below the rocky cliff. These paths often pass near to an isolated boulder under which shelter can be taken if the animals are disturbed during feeding. In any case, the directness of these vertical feeding paths allows very rapid retreat to the living holes on such occasions.

It is extremely difficult to determine what happens inside the the holes. It is impossible to dig out the system, except in a few cases where there is soil on one side of the hole, and the thickness of the dense rock precludes the use of radioactive tagging methods (Godfrey, 1954). Hence it is not possible to say with certainty whether a group of hyrax always live in the same part of a hole system or whether there is any functional subdivision of the system. Circumstantial evidence, however, suggests that there is some constancy in use of various areas of the holes. For example, individual animals tend to use one entrance more than others. The habit of hyrax of having common urinating and defaecating places for each set of holes is widely known (Sale, 1960). It has also been observed that individuals in a group tend to occupy a regular place on the rocks when basking. These facts show that there is a positional constancy in hyrax, and in all probability this also applies when they are inside their holes. Its application must, of course, be adapted to the particular arrangement of holes in which the group is living and it would not be possible to produce the rather stereotype burrow plan that has been presented for many burrowing mammals.

Climate and predators in relation to the habitat

It can be seen from this brief account of colony sites that there is no fixed pattern for the hyrax dwelling. The animal adapts itself to any shelter that provides adequate protection from the elements and predators. In areas where there is a tendency to strong winds the animals avoid using rocks which are facing the prevailing wind, or if they do so they select a set of holes with protected entrances. For example some holes may have entrances on the leeward side of a large boulder. The Uaso Kedong gorge, where many of the present observations have been made, well illustrates the relationship of colony sites to prevailing wind (Fig. 3). The gorge runs in a north-south direction and at times there is a strong easterly wind in the area, especially during the night. This wind blows over the top of the east wall of

the gorge but catches the rocks on the west wall with considerable force and enters any east-facing cavities in these rocks. There are a number of Procavia colonies along the sheltered east wall but no permanent colonies on the west wall and the rocks are heavily covered with lichen. One or two, apparently lone animals have been observed from time to time on the west wall but no real colonies. Other colonies in the area are also on rocks that face west and are thus sheltered from the strong east wind. In areas where, because of the physiography, there is little wind, no such directional bias in the distribution of colony sites is observed.

Climatic data for three areas where Procavia spp. are very common is given in Table 1 and it can be seen that the distribution of this genus shows wide tolerence in relation to altitude, temperature and rainfall. The main connection between rainfall and an herbivore population is the vegetation and this factor has been discussed in a paper on feeding (Sale, 1965). The wide tolerence of the rock hyraces in respect to food plants is largely responsible for the fact that rainfall is not a primary factor in their distribution. Hyrax are adapted to a wide temperature range by their daily behaviour cycle which results in the animals avoiding the thermally extreme parts of the habitat.

Location of Procavia spp.	Altitude	Mean Annual Temperature		Mean Annual Rainfall (approx.)
		Maximum	Minimum	
Magadi	613 m.	35° C	17.8° C	56 cm.
Naivasha	1,900	25	9.4	56
Mt. Kenya	4,200	10	-5.0	89

Table 1.

The exposed rocks on which the lowland hyrax bask during the early part of the day often reach a very high temperature by the middle of the afternoon, with correspondingly low humidity. Air temperature recorded under a canopy above one of these exposed rocks at Uaso-Kedong was frequently up to 39° C with a relative humidity of around 10%. At Magadi even higher temperatures were recorded (Table 2). The night temperature at Uasa-Kedong was 16°- 18° C and humidity up to 85%. Thus the outside air around the rocks shows diurnal fluctuations of temperature and humidity of 23° C and 75% respectively. A simultaneous recording of the temperature (but not humidity) 2m. inside a hyrax hole showed a maximum of 17° C and minimum of 14° C, i.e. an absolute fluctuation of 4° C. No doubt the humidity in the hole was of a similar relative order. Table 2 compares these temperature measurements at Uaso-Kedong with similar recordings at Magadi, a much hotter area, and the Hausberg Valley on Mount Kenya where air temperatures are much lower (recordings here were not made above an exposed rock).

Table 2.

LOCATION	PERIOD	OUTSIDE TEMP. °C			HYRAX HOLE TEMP. °C		
		Mean Max.	Mean Min.	Range	Mean Max.	Mean Min.	Range
Magadi	5 days	41.6	26.0	16.6	31.6	26.7	5.9
Uaso Kedong	7	38.6	17.5	22.1	16.6	14.4	3.2
Mt. Kenya*	4	9.0	-4.0	14.0	9.0	0.6	9.4

In all three areas the air temperature of the hole shows much less fluctuation (range) than that outside and thus provides a relatively constant microclimate into which the animals can withdraw in order to avoid extremes outside. At Magadi the mean minimum outside and in the hole is about the same but the high maximum temperatures on the rocks are never reached in the hole. The converse is true on Mount Kenya, where the mean maxima are the same but the low night temperatures outside are avoided in the hole where it seldom goes below freezing point.

The shade of trees and other vegetation provides the animals with a moderate alternative to the extreme microclimate of the exposed rocks. Measurements of temperature and humidity in heavily shaded areas of the habitat confirm the anticipated intermediate range between figures for the rocks and the hole.

There would appear to be a relationship between local predators and the maximum size of hole entrance regularly used by members of a colony. Except on high mountains, the leopard, Felis pardus pardus L., is a common resident of the rocky areas where hyrax are found and is undoubtedly their main enemy. It is certainly the only major predator that would be likely to enter a hyrax hole. It is noticable that holes that are apparently otherwise ideal for hyrax habitation but have an entrance large enough to allow a large cat, such as a leopard, to enter are never used except for very temporary shelter. Holes, however, that are quite near to the surface but with a confined entrance are quite often inhabited and one can sometimes observe a group of hyrax huddled inside such a hole at very close quarters. They appear to "feel quite secure" even when so near to such a large enemy as man. A comparable manifestation of this "intelligent calculation" by hyrax was frequently seen in my captive colony of Mount Kenya hyrax. On an open roof the animals were extremely afraid of any strange intruder, such as a new human or a dog, and would immediately flee into the shelter of their home. When they were later placed in a wire mesh enclosure, however, a Boxer dog frequently tried to molest them through the wire, barking and rushing at them with open jaws. The

* These figures were kindly made available by the Queen Elizabeth College Expedition to Mt. Kenya, 1964/65.

The hyrax very quickly realised that they were quite safe with the wire separating them from the dog and although the younger animals showed threat, the adults took very little notice at all, sometimes even deliberately sitting with their noses against the mesh while the less intelligent dog charged them ferociously. On Mount Kenya there appears to be only a single pair of leopard in most of the large valleys. Considering the very large hyrax population in these valleys, the rate of predation by leopard must be very low indeed, especially as hyrax is not its only food (Coe, 1963). It is interesting, therefore, to note that the Mount Kenya hyrax often lives in holes with quite large entrances, in some cases large enough to permit human entry. There would seem to be a connection between this habit and the comparative rarity of the leopard, especially as there is no shortage of holes with more confined entrances.

Summary.

Rock hyraces do not burrow but inhabit any type of rock providing suitable cavities as dwelling holes. Although the harder types are most commonly used, holes in sedimentary rocks and even soil, are inhabited in some areas.

There is no fixed pattern for the hyrax dwelling but isolated holes are not generally used. The animals adapt themselves to any shelter that provides adequate protection from the elements and predators. The temperature inside the hyrax hole never reaches the extremes of the outside air temperature. Holes facing the prevailing wind or with entrances big enough to allow the entry of a large predator are avoided, especially in areas where such predators are numerous.

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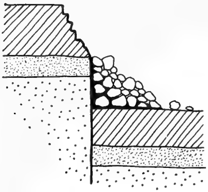
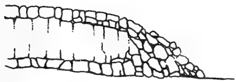
(Received for publication, 13th January 1966)



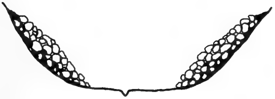
A. A FAULT SCARP

Outer boulders enclosing cavities formed by the washing away of the finer materials.



B. A LAVA FLOW

Cavities formed by removal of slag.



C. LATERAL MORAINES OF A GLACIATED VALLEY (Mt. Kenya).

Fig. 1

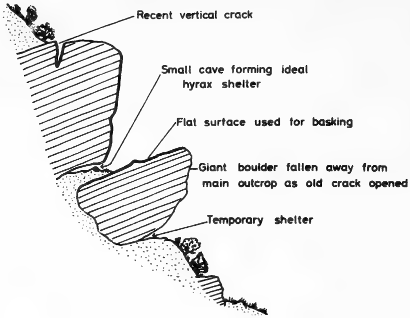


Fig. 2

SECTION OF ROCK OUTCROP SHOWING FORMATION OF HYRAX HABITAT BY VERTICAL CRACKING (e.g. Lukenya).

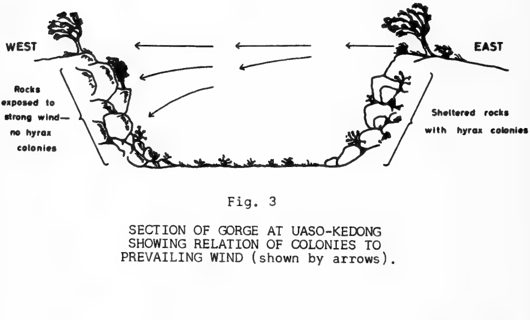


Fig. 3

SECTION OF GORGE AT UASO-KEDONG SHOWING RELATION OF COLONIES TO PREVAILING WIND (shown by arrows).

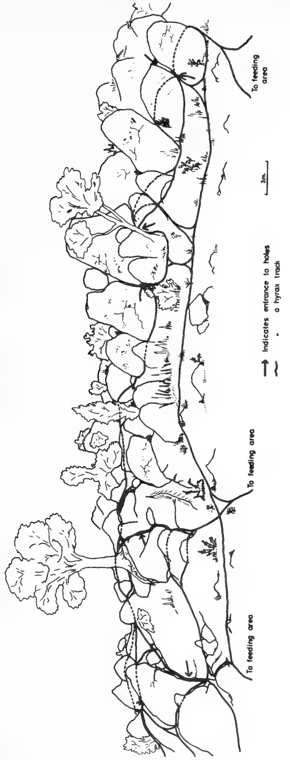
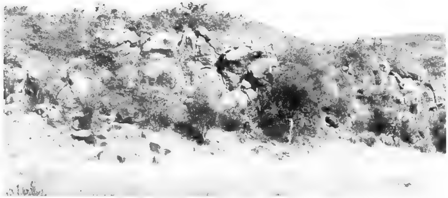


Fig. 4

DRAWING OF A PROCAVIA HABESSINICA COLONY SITE IN THE RIFT VALLEY SHOWING HYRAX HOLES AND MAIN PATHWAYS



1a. Part of the east wall of the Uaso Kedong gorge in the Rift Valley. Fault scarps of this kind are frequently occupied by rock hyrax,whose presence is indicated by white urine stains on the rocks,e.g.the rocks on the extreme left.

1b. The head of the Teleki Valley, Mount Kenya. The lateral moraine in the centre provides an extensive boulder scree habitat, housing a large colony of P.johnstoni mackinderi.

DAILY FOOD CONSUMPTION AND MODE OF INGESTION IN THE HYRAX

By

J.B. SALE
(Zoology Department, University College, Nairobi.)

Introduction

Probably the earliest experiment on hyrax concerned its feeding and was carried out by the 18th Century explorer Bruce, in Ethiopia. He describes (Bruce, 1790) how he shut up a hyrax, which had been starved for a day, in a cage with a chicken. The latter was not eaten by the hungry hyrax. A further experiment involved two small birds which, after several weeks, were also unharmed. From these experiments Bruce concluded that the hyrax was not a carnivore. Most observers agree that hyraces are herbivores and in a recent paper (Sale, 1965a) on the feeding behaviour of rock hyraces, _Procavia_ and _Heterohyrax_, in Kenya it has been shown that these have catholic dietary habits. A study of the social behaviour of feeding shows rock hyraces to have some patterns similar to the feeding behaviour of ungulates.

The earlier paper emphasised the speed and intensity of feeding in rock hyraces. The total time any colony has been observed group feeding is under one hour per day which, by comparison with many herbivores, is extremely brief. This suggests that either the food consumption of the hyrax is relatively low or that the mode of ingestion permits an unusually rapid rate of food intake. The present paper represents an attempt to elucidate these two factors.

In addition to extensive field observation of feeding colonies, detailed information on the amount eaten and mode of ingestion has been obtained from a captive colony of Mount Kenya hyrax, _Procavia johnstoni mackinderi_ Thomas. For the estimation of food and water intake and the collection of urine and faeces a metabolism cage, to house a single animal, was built (the details of which are being published elsewhere) and kept in a temperature-controlled room.

Amount Eaten.

It is always difficult to assess the amount of food eaten by animals under natural conditions. A certain amount of information can be obtained by weighing the stomach contents of dead animals but this method is unreliable for several reasons. Unless a very large number of animals have been previously examined, it is impossible to state with accuracy the degree to which a stomach is filled. Hence, the contents of what appears to be a full stomach, may in fact represent only half a full meal. In any case, few animals eat the same amount at every meal. Only in rare cases where the behaviour of an animal, for a considerable period prior to death, has been observed, will the exact significance of the stomach contents be known. The method is destructive, uneconomic and denies the possibility of a series of measurements from the same individual, which is essential if any fluctuations are to be recorded. A very large number of "spot" observations of this kind are needed for a given species before a true assessment of the quantity of food it eats can be obtained.

Hyrax in the wild normally have an abundance of food except during rare drought conditions (Sale 1965a). It can thus be assumed that unless some disturbance curtails a feeding period, an animal will eat as much as it requires during each day. An animal that is well settled in captivity and being liberally fed ought, therefore, to give a fairly accurate assessment of the quantitative food requirements of a member of its species of the same age group and sex. A fully adult Mount Kenya male was kept in the metabolism cage and accurate records were maintained of the amount of food put into the cage and the amount uneaten at the end of 24 hours. During the period October 1962 to March 1963, when the room temperature was constant around 21° C (relative humidity varied between 44 and 56%), two contrasting types of food material were given. Freshly-collected sow thistle (Sonchus sp.) was fed for the first six weeks and then replaced by lucerne hay. The animal had eaten both these foods equally well during three months in captivity prior to the experimental period. Water-content, nitrogen and crude protein determinations of samples of the food were carried out at intervals and average values for each food over the period obtained. While being fed on Sonchus, the animal had no water but was given water ad lib while being fed on lucerne. A summary of the data obtained is given in Table I.

It can be seen from Table I that there is a very great difference between the daily intake of Sonchus (896 gm) and lucerne (119 gm). This can largely be accounted for by the fact that the former contains much more water (86.6%) than the latter (15.2%). The dry matter intake of the two feeds shows very little difference and appears to be the main factor determining the total amount of food consumed. The much larger quantity of fresh Sonchus was apparently not taken in order to obtain water. The urine output decreased significantly when water was mainly obtained through drinking (while feeding lucerne), suggesting that in the first period, water obtained from the Sonchus was in excess of requirements. There was also a great increase in the concentration of the urine in the second period, further demonstrating that water was consumed in excess during the first period.

It is clear from these experimental results that the water content of the food greatly influences the amount consumed. Hence the weights of wet stomach contents are a completely unreliable guide to the amount of food being consumed by an animal. If expressed as dry matter, a more useful comparison can be made but will still be subject to the objections stated above.

While the dry matter intake of the two foods was similar, the Sonchus provided over 100% more nitrogen and crude protein than the lucerne. Since there was always uneaten lucerne in the cage, it can be assumed that the nitrogen and crude protein provided by the daily intake of this food was adequate. This means that the nitrogen and crude protein provided by the Sonchus intake were in great excess of requirements and, like the water provided by the Sonchus, were not critical factors in determining the amount of the food consumed. The only factor which shows approximate equality in the two food intakes is the dry matter which must therefore basically determine the amount of a food consumed.

The "voluntary" lowering of the water intake with a lessening of protein intake may reflect a built-in mechanism which cuts down water requirements when the quality of vegetation decreases. Such a protein decrease in the plants takes place during the dry season when water

is also short. A mechanism of this kind has recently been demonstrated in native cattle (Payne, 1963) and, if present in hyrax, would partially account for its ability to live for long periods in very arid areas such as the Sahara (Monod, 1963; Grasse, 1956).

The data obtained from this one animal suggest that a large adult male Mount Kenya hyrax will eat approximately 111 gm. (average figure) of dry matter per day. For this animal, weighing 3.3 kg., this is 33.6 gm. per kg. body weight per day. Table 2 compares this ratio with that of other species. The hyrax ratio is in the same range as that of sheep which vary according to body weight, e.g. 31 gm. per kg. body weight for an animal of 79 kg. (Spector, 1956); 34.5 for an animal of 60 kg. (Woodman 1948). This means that for its size the hyrax has a modest food intake, as the ratio normally increases as body weight decreases.

The reason for a relatively low food intake may be that the hyrax is not a very active animal and spends the major part of the day huddled in a hole or lying outside on the rocks (Sale, 1965). It is a marked feature of Table 2 that very active animals such as the Wallaby and Howler Monkey have abnormally high food intakes. Figures could not be obtained for markedly inactive mammals but it seems likely that the converse of the above trend would operate in such cases. An additional factor is that hyrax exhibit a higher degree of thermolability than many mammals (unpublished observation) and will thus use less energy for their size. The low food intake is undoubtedly a significant factor contributing to the ability of the rock hyraces to inhabit areas where vegetation is sparse or of a poor nutritional quality and may also be partially responsible for the fact that they spend relatively little time feeding.

Mode of Ingestion

Use of the feet:

The feet are not extensively used in hyrax for manipulating food. Sometimes a tall herb or small shrub will bear shoots and leaves out of the reach of a feeding animal. If the plant is not stout enough to be climbed, the hyrax may raise itself up and press on the stem about 20 cm. from the ground with its forefeet, thus bending or breaking the stem and bringing the edible parts of the plant within reach. A similar technique is often used by goats and browsing antelopes such as the Gerenuk, Litocranius walleri Brooke. If a difficult piece of food is encountered on the ground one of the forefeet may be employed to steady it while a portion is being bitten off. This happens far more frequently in captivity than in the wild. Food such as carrots or mealies which tend to roll around are often held in this way while the side of the mouth is brought into position and a bite taken.

Hyrax have never been observed carrying food into their holes in the wild, although occasionally one finds evidence that a small twig has been dragged into the hole and stripped of its leaves. Even shy newly-captured animals rarely take food into the dark part of the accommodation but generally eat it outside when undisturbed. Mollaret (1962), who has kept both Procavia and Dendrohyrax in captivity, states that only Procavia uses its feet to hold food which it often drags into its shelter to eat there. He does not offer any explanation for the lack of such behaviour in Dendrohyrax but it may be connected with the fact that this genus is more easily tamed than Procavia, which he admits is the more aggressive and difficult to handle. A tame animal would probably be less afraid of eating in an

exposed place than one which was uneasy in captivity. Also Dendrohyrax, being nocturnal, always eats at night.

Unlike many small mammals, hyrax do not pick up objects with their forefeet. The pad-like structure of the feet and absence of really separate prehensile digits (Plate Ib) which make it difficult to do so. The gait of hyrax too, is not predisposed to such action. Mammals, such as many of the rodents, that grasp and lift objects with their hands have long hind limbs on which they are able to walk and sit erect easily, without overbalancing. Although hyrax can stand erect momentarily (tame animals do it when begging for food), they are unable to walk for more than a few steps or sit still in this upright position. The body-shape of the hyrax is similar to that of a bear but the shorter trunk of the latter enables it to balance in the sitting position more easily.

Use of the teeth.

The upper incisors of hyrax are widely separated and developed into a pair of sharp tusks (Plate Ia), triangular in cross-section. The lower incisors, of which there are two pairs, are flattened and deeply incised so as to form comb-like structures used in cleaning the fur, like those of the lemur. Hence the incisors are unsuitable for biting off small shoots and they are little used in ingestion. The normal mode of browsing is to turn the head sideways (at 90° to the body) and bite off the shoot or leaf with the molar teeth and take it in through the side of the mouth (Plate Ic). Hyrax look rather clumsy when feeding and remind one of a carnivore gnawing a large bone which remains projecting from the side of the mouth (Plate Ib). The use of the molars in cropping leads to the distinctive flat-topped appearance of the tussocks of Festuca sp. on Mount Kenya (Plate IIa). Hyrax can be seen with their heads twisted, so as to bring the side of the mouth into a horizontal position during this cropping operation.

The relatively long cutting edge provided by the molars (Plate IIb) enables a large amount of food material to be taken at each bite and thus assists in rapid feeding. The greatest advantage of this will be realised during grazing or cropping when the whole length of the molar row is in use. A rough comparision of the length of the cutting edge and dry matter intake rate in relation to body weight in the hyrax and two grazing ruminants, where the lower incisors form the cutting edge, is given in Table 3 (for authorities see Table 2). It is thus clear that for a herbivore of its size the hyrax can take in food at a very great rate and this must largely account for the relatively brief feeding time.

There is occasional use of the incisor teeth and tongue in ingestion, as follows. If the material is a little out of reach, then, with the neck outstretched, the upper incisors may be used in conjunction with the tongue, the latter pressing the leaf up onto the incisors. The neck is then contracted and as the leaf is pulled, it either breaks along the line of the incisor perforations or it breaks off at the base of its petiole. In the latter case the whole leaf is obtained and can be seen impaled on the upper incisors and projecting from the front part of the animal's mouth. It is removed with the aid of the tongue and the lower incisors.

The lips do not appear to be used in the ingestion of food material but are employed in drinking which strongly resembles that of ungulates. The lips are lowered to just below water level and water is sucked into the mouth in gulps as the lips are slightly parted. The tongue plays very little part in the process.

Rumination and refection.

Ingested food material is rapidly chewed in a side-to-side motion before swallowing. Throughout my observations of rock hyraces I have found no evidence of rumination. Hyrax will sometimes produce a chewing motion without having recently ingested and such action is particularly common when they are confronted by something which is strange to them. It has been observed, for example, when captive animals are introduced to an unfamiliar animal species such as a caged bird. Newly-captured and nervous animals frequently show it when being observed by humans. This motion reminds one forcibly of a ruminant and is probably responsible for the statement by some observers that hyrax chews the cud (Bruce, 1790). Very low intensity pilo-erection is also manifest on such occasions indicating a conflict response to the strange situation (Sale, 1965b).

Recently Hendrichs (1963) claims to have observed rumination in P. capensis in captivity in Europe. He informs me (Hendrichs 1965) that the animals chewed the cud for ½ hr. (in 24 hr.) when fed on dried grass (? hay). Until more details of these observations are available it is unwise to comment but my own view is that although hyrax sometimes chew in the absence of ingestion, they do not regurgitate material from the stomach for further mastication. The simple structure of the stomach would appear to make such action extremely unlikely. Should rumination in the hyrax be established, the accuracy of the Bible (Lev. XI, 5), where the coney is stated to chew the cud, will be attested.

Refection would seem to be a more likely phenomenon in the hyrax than rumination. The process is known to exist in the wild rabbit (Madsen, 1939; Southern 1940,a) and Southern (1940,b) has drawn attention to its possible usefulness during enforced long periods in the burrow due to bad weather or disturbance preventing feeding. Coe (1962) instances a colony of Mount Kenya hyrax that "remained below ground for three days" during a period of bad weather. Although I have no concrete evidence of such prolonged periods without feeding, it seems likely that hyrax can stay in their holes for more than 24 hr. Coprophagy would clearly be a potential mode of nourishment during periods of confinement. Captive hyrax have frequently been seen to sniff and lick fresh faeces but the occurence of actual ingestion has not yet been established. The occurence of refection in the hyrax would provide an interesting comparison with the elephant, where the eating of a quantity of fresh faeces has recently been reported (Dougall and Sheldrick, 1964).

Discussion.

The development of a pair of upper incisors as defensive tusks is one of a number of characteristics that hyrax have in common with the elephant. In both cases this has precluded the use of the incisors for biting and alternative modes of ingestion are used. The elephant has developed the trunk as a highly efficient organ of prehension and suction, unparalled among the mammals. The hyrax have a less unconventional mode of ingestion using the molar teeth, which, because of their long cutting edge allow a large amount of food to be taken in at a time, especially when cropping leafy vegetation. It is interesting that while the elephant is the largest ungulate-type mammal, the hyrax is the smallest. The efficiency of the trunk in ingesting large amounts of food material has undoubtedly contributed to the great size of the modern elephant and enabled the group to radiate out from Africa where it had its origins. The hyraces, on the other hand, have

become smaller in size and largely remained confined to Africa where they appear to have had a common origin with the probiscideans in the late Eocene (Romer, 1933). This decrease in size is, however, probably due to the fact that the hyrax has remained plantigrade and has never been capable of the rapid locomotion that enables modern ungulates to escape from predators. Hyraces have therefore left the plains for the protection of rocky outcrops or hollow trees, their sharp incisors being ideal for the defence of the entrance to a hole. This change in niche has necessitated a decrease in size as few existing holes are large enough to house the Oligocene hyraces which were the size of a large hog. Changes in niche and body size have been accompanied by behavioural changes. In general these have involved decreasing activity, resulting in a lowering of relative food requirements.

The survival advantage, to a small herbivore such as hyrax, of a short feeding period, involving maximum exposure to predation, is clear (Sale, 1965a). The factors contributing to the shortness of the feeding time in hyrax, viz a low food intake and rapid mode of ingestion, would seem to have been produced by the physiological and anatomical changes accompanying the change of habit from plains-dwelling grazer to a rock-dwelling browser.

Summary

The dry matter content of a food determines the amount of it that a hyrax will eat. Foods with a low protein content probably demand a lower water intake than those rich in protein. The dry matter intake of an adult Procavia was found to be 33.6 gm per kg. body weight per day, which is low for an animal of this size and may be connected with the relatively inactive life and poor temperature regulation of the rock hyrax.

Hyrax rarely use their feet in grasping food material which is seldom carried into the holes. The development of the incisors for defence and toilet purposes makes them unsuitable for use in ingestion. The molar teeth are used to bite off plant material, an action often necessitating the turning of the head sideways. The cutting edge provided by the molars is relatively long and enables the animal to take in a large amount of food material, thus contributing to the rapid feeding of hyrax.

Acknowledgements

The analyses of food materials were kindly carried out for me by the Biochemical Unit in the Animal Husbandry Division of the East African Agricultural and Forestry Research Organisation, by courtesy of Dr. L.J.A. Payne to whom I am greatly indebted. I am also grateful to the Rockefeller Foundation, New York and to the former Royal College, Nairobi for financial assistance.

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(Received for publication 13th January 1966)

Food Consumption in the Hyrax

FOOD	Period in days	Water Content Av. %	DAILY CONSUMPTION IN GM.					
			Av.	Max.	Min.	Dry matter	Nitrogen	Crude protein
Fresh Sonchus	39	86.6	896	1940	201	122	3.68	23.08
Lucerne hay	55	15.2	119	280	69	101	1.64	10.28

A summary of food intake data obtained from an adult male (weight 3.3 kg.) Mount Kenya hyrax in the metabolism cage under constant environmental conditions.

TABLE 1.

SPECIES	BODY WT.	Dry matter per kg. body wt. per day
Procavia	3.3 kg.	33.6 gm.
Elephant (African)	3409	29
Zebra (Grevy)	409	20
Wallaby (M. agilis)	5	280
Wombat	9	63
Giraffe	1134	28
Howler monkey	3	238
Beef cattle	800	15
Sheep	60	34.5
Rat	0.3	50

A comparison of the daily food (dry matter) intake of various mammals. Compiled from Albritton (1954), Spector(1956) and Woodman (1948).

TABLE 2.

	A. Body Wt.	B. Cutting edge	$\frac{A}{B}$	C. Dry matter per kg. body wt. per day	D. Time spent feeding per day	$\frac{C}{D}$
Procavia	3.3 kg.	3 cm.	1.1	33.6 gm.	.66 hr.	50.8.
Sheep	79	3	26	31	10.5	2.95
Cow	800	8	100	15	6.5	2.3

TABLE 3.

Plate Ia The incisor teeth of a male hyrax. The lower incisors of this old animal are worn down to peg-like stumps and are no longer comb-like.

Plate Ib An animal eating a leaf which remains projecting out of the side of the mouth. The peculiar form of the feet can also be seen.

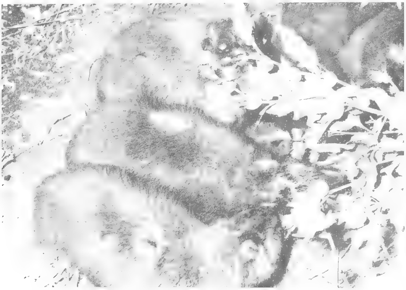

Plate Ic Browsing hyrax, showing how the head is turned sideways as vegetation is bitten off with the molars.

Plate IIa Tussocks on Mount Kenya that have been cropped by hyrax, resulting in a characteristic flat-topped appearance.

Plate IIb A skull from the side showing molar teeth. The outer cutting edge of the upper molars overlaps the narrower lower molars when the jaws close,thus producing a scissors action.

NOTES ON EAST AFRICAN COWRIES

By

E. ROBSON

This up to date list has gradually been compiled by various East African collectors. My particular thanks are due to Ken Fuller and Misha Fainzilber for data concerning the more recent additions, numbers 7, 31 and 42, which have been found in Dar-es-Salaam and Zanzibar. I have just added No. 43 which has been found at Shelly Beach and at Shimoni. Quite a few E. marginalis with their distinct violet base and B. oweni with deep cut teeth have been found at Zanzibar and also the little P. microdon. The once rare Cribraria chinensis was quite common in 1965 along the Diani Beaches.

The Cowry collection at the National Museum has been sorted out and a representative collection is on view but is not yet complete, Nos. 23, 29, 31, 41 and 43 being still required to complete the series.

I am preparing a collection of colour slides of shells - and cowries in particular, and hope to show these to interested people during 1966. There is considerable interest in East African varieties of such cowries as A. histrio, A. arabica, P. ziczac, M. moneta and L. mappa as we seem to have more than the usual known varieties here.

Information on lesser known reefs and pools between Jadini and Shimoni is required, particularly details of specimens found, habitat and localities. A list of shells from the Lamu area and of beaches north of Malindi would also be welcome. Mrs. L. Cameron is collecting information on the colour and appearance of the bodies of Cowries, which should, when available, assist in the identification of specimens caught alive.

List of Cowry Shells (CYPRAEIDAE) Recorded from the E. African Coast

Genus	Species	Subspecies or variety	Author	Common Name
Subfamily ADUSTINAE				
1. Adusta	onyx	adusta	Lamarck, 1959	onyx
2. Cribraria	cribraria		Perry, 1811	spotted cowry
3. Palmadusta	clandestina	passerina	Melvill, 1858	false 3 banded
4. "	ziczac	diliculum	Reeve, 1845	ziczac
5. "	ziczac	virginalis	Schilder, 1939	ziczac
6. "	ziczac	misella	Perry, 1811	pale ziczac
7. "	contaminata	distans	Schilder, 1939	
Subfamily Cypraeinae				
8. Lyncina	lynx	lynx	Linnaeus, 1758	lynx
9. Cypraea	tigris		Linnaeus, 1758	tiger
10. Leporicypraea	mappa	alga	Perry, 1811	map
11. "	mappa	mappa	Linnaeus, 1758	map
12. Ponda	carneola	sowerbyi	Anton, 1839	flesh
13. Mystaponda	vitellus	dama	Perry, 1811	fallow deer
Subfamily ERRONEINAE				
14. Bistolida	stolida	diaudes	Melvill, 1888	square spot
15. Blasicrura	kieneri	kieneri	Hidalgo.	false swallow
16. "	oweni		Sowerby.	owen
17. Ovatipsa	caurica	caurica	Linnaeus, 1758	
18. "	chinensis	violacea	Rous, 1905	violet
19. Talostolida	teres	subfasciata	Link, 1807	long

Genus	Species	Subspecies or variety	Author	Common Name
Subfamily EROSARIINAE				
20. Erosaria	erosa	erosa	Linnaeus, 1758	
21. "	lamarcki	lamarcki	Gray, 1825	
22. "	marginalis	pseudocellata	Schilder, 1939	margined
23. "	nebrites	mozambicana	Schilder, 1939	
24. "	turdus	turdus	Lamarck, 1810	thrush
25. Monetaria	moneta	moneta	Linnaeus, 1758	money
26. "	moneta	icterina	Lamarck, 1810	money
27. Ornametaria	annulus	camelorum	Iredale, 1939	gold-ring
28. Ravitrona	caputserpentis	caputserpentis	Linnaeus, 1758	serpents head
29. "	gangranosa	reentsii	Dunkir, 1852	
30. "	helvola	argella	Melvill, 1888	star
31. "	poraria		Linnaeus, 1758	porous
Subfamily MAURITIINAE				
32. Arabica	arabica	immanis	Schilder, 1939	arabian
33. "	depressa	dispersa	Schilder, 1939	
34. "	histrio		Gmelin, 1791	harlequin
35. "	scurra	scurra	Gmelin, 1791	jester
36. Mauritia	mauritiana	mauritiana	Linnaeus, 1758	hump back
Subfamily NARIINAE				
37. Evenaria	asellus	asellus	Linnaeus, 1758	three banded
38. "	punctata	punctata	Linnaeus, 1758	punctate
39. Milicerona	felina	felina	Gmelin, 1791	cat
40. Paulonaria	fimbriata	durbanensis	Schilder, 1939	
41. "	gracilis	notata	Gill, 1859	
42. "	microdon	chrysalis	Kiener, 1843	small toothed
43. Evenaria	hirundo	hirundo	Linnaeus, 1758	swallow
Subfamily PUSTULARIINAE				
44. Pustularia	cicercula	lienardi	Josseaume, 1843	
45. "	globulus	brevirostris	Schilder, 1939	
Subfamily STAPHYLAEINAE				
46. Nuclearia	nucleus	madagascarensis	Gmelin, 1791	
47. Staphylaea	limacina	interstictina	Wood, 1828	
48. "	staphylaea	laevigata	Dautzenburg, 1932	
Subfamily TALPARIINAE				
49. Arestorides	argus	contrastriata	Perry, 1811	pheasant
50. Basilitrona	isabella	isabella	Linnaeus, 1758	isabella
51. Chelycypraea	testudinaria	ingens	Schilder, 1939	tortoise
52. Talparia	talpa	imperialis	Schilder, 1939	mole

(Received for Publication October, 1965)

SIGHT ADDITIONS TO THE AVIFAUNAL LIST OF ETHIOPIA

By

EDWARD W. BEALS

During three years of residence in Ethiopia, from September 1962 to July 1965, I have had the opportunity of travelling widely in that country. From bird records kept, I have found nine species, identified without any doubts, that are apparently not previously recorded for Ethiopia. I have had no opportunity to collect birds, but these records may be of interest as additions to the hypothetical list of Ethiopian birds. Locations are numbered on the map. I must point out that the distribution of these records on the map reflect more the time spent in various areas than the choicest birding sites. The concentration of records is in the Main Ethiopian Rift, where I have done the most field work. Comments on previously known range are taken from Praed and Grant (1957-1960).

Anthropoides virgo (Linn.) Demoiselle Crane.
Two flocks seen, one of 12 birds on October 16th 1962, in a grassy marsh just north of Bishoftu (Loc. 1); the other of 17 birds on January 21st 1963, in a grass field on the west side of Lake Zwai (Loc. 2). Previously stated to visit the Sudan "in enormous numbers."

I might also add that *Megalornis grus* (Linn.), the Common Crane, which was reported by Smith (1957) in Eritrea, has been found in the Rift Valley in open *Acacia* savanna 20 km. west of Shashamanne (Loc.3), a flock of 5 birds on February 8th 1963.

Trochocercus albonotatus Sharpe. White-tailed Crested Flycatcher.
Two birds seen, one on the edge of secondary forest (in *Podocarpus* zone), 15 km. south of Shashamanne (Loc. 4) on April 6th 1963; and a second in similar but wetter forest 10 km. southwest of Jimma (Loc.5) on June 14th 1964. White spots in tail were seen clearly. Uganda and western Kenya were previously considered its northern limit.

Sylvia rüppelli Temminck. Rüppell's Warbler.
One male bird seen in *Acacia* scrub just west of Massawa (Loc. 6) on February 17th 1964. White moustache and black throat were seen clearly. Two other birds in the vicinity may have been females of this species. Previously described as a "locally common palaearctic winter visitor" to the Sudan.

Phylloscopus bonelli (Vieillot). Bonelli's Warbler.
One bird seen in *Terminalia*-*Anogeissus* woodland, on the escarpment west of Massawa (Loc. 7) on January 20th 1965. Yellow rump and whitish underparts were unmistakable. Previously recorded as far south as the Sudan.

Psalidoprocne albiceps Sclater. White-headed Rough-wing Swallow.
Four black swallows, two with white heads, were seen on August 14th 1963, on the edge of a *Balanites-Acacia* forest along the southwest shore of Lake Margherita (Loc. 8). It has previously been recorded as far north as the southern Sudan.

Corvus ruficollos Lesson. Brown-necked Raven.
In a flock of six black corvids seen on the coast at Assab (Loc.9)

on January 8th 1963, two were distinctly larger than the other four, has more distinctly brown heads, and had proportionately heavier bills. Their call was a high-pitched croak, in contrast to the 'caw' of the four smaller birds. Blair (1961) and North (1962) suggest that C. edithae Phillips and C. ruficollis are distinct species. Bird records from Ethiopia have been referred to C. edithae (Smith assumes this for the Eritrean coast). The two larger birds were definitely C. ruficollis.

Nectarinia kilimensis Shelley. Bronze Sunbird.
One male seen on August 16th 1963, in open Combretum savanna 25 km. west of Dilla (Loc. 10). The green head, bronzy chest, and elongated tail feathers were clearly seen. Described previously as common and widespread in Kenya.

Nectarinia erythrocerca Hartlaub. Red-chested Sunbird.
One male seen in Acacia scrub along the east shore of Lake Margherita (Loc. 11) on March 17th 1964. The red band quite across the chest and the elongated tail feathers were distinctive. Previously reported from the southern Sudan southwards.

Uraeginthus cyanocephalus (Richmond). Blue-capped Cordon-Bleu.
Two males and at least one female were seen in a large mixed flock, (including many U. bengalus (Linn.), the Red-cheeked Cordon Bleu), on April 23rd 1965, in the Fafan Valley, 20 km. south of the Harar-Jijiga road (Loc. 12), in Acacia woodland. The clear all-blue head (of the males) and red bill (of both sexes) were distinctive. Previously reported from Kenya and southern Somalia southwards.

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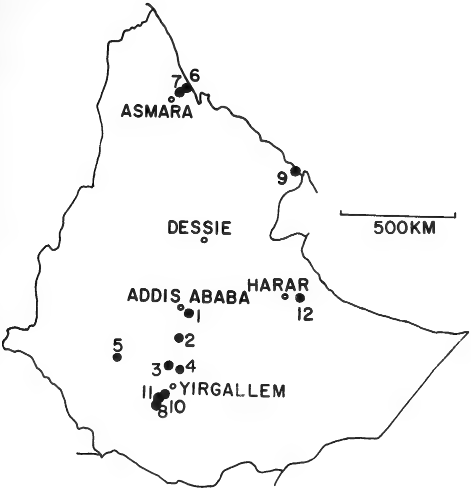
(Received for publication 21st July 1965)


ASMARA
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ADDIS ABABA
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10

NATURE NOTE

Lake Abiata, Ethiopia, Weavers and Gabar Goshawks.

Lake Abiata is one of a group of lakes at about 5,000 ft. altitude, about 150 miles south of Addis Ababa. They are a continuation Northwards of the Rift Valley chain of lakes; but at this point the Rift has no escarpment and the road descends gradually into flat thorn country with birds mostly familiar to an observer from East Africa.

A river runs into the lake, and along the banks are several colonies of the Black-headed Weaver, Ploceus cucullatus (Müller) one of which I saw being searched by three Gabar Goshawks, Micronisus gabar (Daudin), two grey and a black, intent on robbing the nests. They did not tear the nests to pieces as recorded by Praed and Grant, but each seized hold of the entrance to a nest and thrust its head inside. I have seen a Harrier Hawk do this; but the Gabar has not got such a long neck and is anyway a smaller bird. To get the head well into the nest the shoulders had to go too, while the wings were half closed and hung down like those of a moth. At this point the male Weaver would spring into action, striking the hawk's body with an audible thwack. The head would then be withdrawn. I never saw them pull anything out. A young bird or sitting female would no doubt have been devoured; but the Weavers were not at that stage. The females were still bringing leaves to line the nests, and the hawks would potter about in the bush before beginning their search long enough to give everyone time to get out. Most of them withdrew to a safe distance, and only a few males, perhaps those whose nests were being searched, remained to put up a resistance. The hawks would go away, but returned again and again during the afternoon. The relationship between them puzzled me. One was slightly larger than the others, so I took them to be a female and two males, perhaps a family party. In that case the black one must have been a male, as it was one of the two smaller. (Jackson says the black ones are usually females).

P.M. Allen. 23/7/65.

A REEF HERON AT LAKE NAKURU, KENYA.

By

MYLES E.W. NORTH

On 3rd May 1965 at Lake Nakuru, a Reef Heron, _Egretta schistacea_ (Ehrenberg), was seen and positively identified by Mrs. A.J. Hanna, her son Harold and myself. Praed and Grant (1952:46) gives the range of this species in Eastern Africa as the coast of the Red Sea, the Gulf of Aden and probably Socotra Island, so it would appear that the bird which we saw was nearly a thousand miles south-west of its normal haunts.

Our bird was observed for a considerable period - nearly an hour - fishing in the shallows at the north-western corner of the lake. It was very tame, allowing us excellent views through binoculars at a range of 30 to 60 yards. Luckily, a Little Egret, _Egretta garzetta_ (Linnaeus), in the normal white plumage, was also fishing nearby, and its shape and size at once proved that our bird could not be a Little Egret in the grey, melanistic plumage, which was, of course, the first alternative to consider.

Our bird's plumage was uniformly dark grey, except for the chin, which was white. It had an _extremely long, orange-yellow bill_, neutral greeny-coloured legs and _bright, lemon-yellow feet and toes_. It looked exactly similar to the coloured illustration of the'blue' phase of the Reef Heron in Meinertzhagen (1954:399), except that the bill was more orange, the pectoral plumes more prominent and the dorsal plumes less prominent. Compared with the Little Egret already mentioned, our bird was larger and broader, with longer legs, and its yellow bill was longer and thicker than the short, slender black bill of the Little Egret. A Great White Egret, _Casmerodius albus_ (Linnaeus), which alighted beside our bird was considerably the taller.

Our bird fished in a few inches of water near the lake edge by making little dashes on foot with wings slightly raised to catch fish 2-3 ins. long, and it caught many in this way while we were watching. Unfortunately we had no long-focus camera handy, and when Mr. D.A. Turner made a special journey to Nakuru a few days later to photograph the bird, it had disappeared. Therefore, this is purely a sight-record, though I have no doubt concerning its correctness.

Mr. J.G. Williams has shown me a specimen of a Reef Heron from Kenya in the National (formely Coryndon) Museum at Nairobi. The label shows that this bird was collected at Lake Rudolf in the Northern Province on 22nd March 1947, but no further information is provided. In this specimen the exposed portion of the culmen measures 104 mm as compared with only 89 mm for a typical Little Egret. The long bill was a prominent feature of the bird which we saw at Nakuru. I spent much time on the southern shore of the Gulf of Aden when stationed in ex-Italian Somaliland during the years 1941-5. Here I became familiar with Reef Herons, which looked and behaved exactly like our Nakuru bird.

Since this species appears to be normally coastal, it is odd that the two Kenya records mentioned here are both from inland. However,

Williams (1963:25) states that there are unconfirmed reports of its presence on the northern Kenya coast. Records of Reef Herons from anywhere in East Africa south of the Gulf of Aden would be of considerable interest. For identification, the first feature to observe is the dark legs and contrasting yellow toes which occur only in three East African herons - the Reef Heron, the Little Egret and the Black Heron, Melanophoyx ardesiaca (Wagler). The Reef Heron has a long yellow bill; plumage usually grey, sometimes white. The Little Egret has a short black bill; plumage usually white, sometimes grey. The Black Heron has a short black bill; plumage black.

We would like to thank Messrs J.G. Williams and D.A. Turner for their advice and help.

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PRAED, C.W.M. and GRANT, C.H.B. (1952). Birds of Eastern and north eastern Africa. Longmans Green, London.
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(Received for publication 20th September 1965)

A FURTHER NOTE ON REEF HERONS IN EAST AFRICA

By

ALEC FORBES-WATSON

I have been privileged to see Mr. Myles North's article before publication. He has asked me to append the following summary of my observations. Like his, they are solely sight-records unsupported by specimens.

I have seen undoubted Reef Herons at Aden and one on Socotra Island in 1964, and they were breeding alongside Little Egrets (and other herons) at Tananarive, Madagascar in October 1965 (both species were in the white phase). Apart from a group of c.20 white birds seen on a reef near an islet off the west coast of Pemba Island in November 1963, all the Reef Herons I have seen in East Africa have been of the dark grey phase, except for one paler 'lavender' bird identical to similar birds seen at Aden, and four white birds (probably of this species) seen at Kilifi.

Between July 1960 and October 1962 I was the Game Warden in charge of that portion of N.W. Kenya which includes Lake Rudolf. Whenever I visited Ferguson's Gulf, about half-way up the west coast of the lake, I looked for Reef Herons, and there was usually only one to be seen somewhere near the old rest-house. All these were of a rather dark grey (but not blackish) colour, except for the 'lavender' bird mentioned above, which was a pale washed-out looking pinkish-grey; all had a whitish chin.

One evening in July 1958 I was in a boat some way up Kilifi Creek with my brother, the late Mr. N.M. Forbes-Watson, and Mr. Ian Parker, when three dark and four white egret-sized herons flew down the creek towards Kilifi township. Mr. Parker was then the Game Warden at Kilifi, and he told me he had seen similar birds near Kilifi on several occasions. I have never identified a dark-phase Little Egret, and strongly suspect that these coastal birds were also Reef Herons.

I cannot improve upon the field-characters already given by Mr. North. For all the birds positively identified - that is, with the exception of those seen at Kilifi - the very long bill, part of which, at least, is yellow, is the best field-character for distinguishing Reef Herons from Little Egrets.

(Received for publication 20th September 1965)

"THE BUTTERFLIES OF MALAWI"

By

D. Gifford

1965. Society of Malawi. Price 50/- Shs.

This small book of one hundred and thirty-six pages deals with all the five hundred odd species of butterflies recorded from Malawi in an admirably clear and concise fashion. The book is constructed as a running key which will enable Lepidopterists to identify most of the species mentioned with little trouble. All original references are given, as well as type localities, synonymy (for Malawi only), distribution and habitat in Malawi and food plants when known. Descriptive material has been kept down to a minimum for obvious reasons of economy, but the characters on which the key is based are adequate for the identification of the majority of species.

Classification and nomenclature are in accordance with the most recent published work and there is a full bibliography which occupies the last nineteen pages of the book. There are nine plates in full colour, illustrating one hundred and forty species.

As Sir Malcolm Barrow points out in his foreword, although comprehensive works have been published on the butterflies of South Africa, Rhodesia, Kenya and Uganda, no such works exist on the very rich butterfly fauna of the intervening areas and the present work will help to fill a gap of long standing in the literature.

The value of the book would have been enhanced at little extra cost by the addition of a few halftone plates and of more information on the general distribution of the species.

"The Butterflies of Malawi", as well as being an important contribution to our knowledge of African butterflies will be of the greatest value to the intelligent amateur.

R.H.C.

APPRECIATION

Mr. N.P. Mitton.

The news of the death of Mr. N.P. Mitton in a car accident has been a sad shock to his many friends and admirers.

Norman Philip Mitton was born in West Bromwich in 1916. At an early age he developed a passionate love of nature, and an absorbing interest in the techniques connected with the preservation and display of Natural History objects. He was trained as a taxidermist in Birmingham, and came out to Africa in 1938, where he knew he would find greater opportunities for perfecting his techniques and more scope for his talents. His war service in the army took him to Ethiopia and East Africa during the early part of the war, and it was then that he came to know and love the East African scene which he was to portray so effectively in some of his later work.

After 1942 Norman Mitton served as a gunner in the Middle East and in Italy until the end of the war, and then returned to Africa in 1945. He was employed by the Transvaal Museum as Taxidermist for a few years, but seized the first opportunity to return to his beloved East Africa, when he was offered a post on the staff of the Coryndon Museum by Dr. L.S.B. Leakey, in 1950.

At that time, thanks to the enthusiasm and dedication of Dr. Leakey, funds had been raised for extensions to the old Museum which more than doubled its original exhibition space. Mr. Allen Turner, a man of advancing years and failing health, had up to then been responsible for the preparation and display of all exhibition material. The task of preparing new exhibits for the large new empty galleries was clearly too much for one man, and Norman Mitton assisted him at first and took over complete charge of the work a little later, when Allen Turner died.

Norman Mitton met the formidable challenge of re-organising the entire Museum with hard work, selfless dedication, unerring taste and with an uncanny grasp of technical problems. Step by step, despite a perennial shortage of finance, staff and equipment, the Coryndon Museum became one of the finest in Africa and a source of pride and prestige to Kenya.

Much of what the visitor of today admires in what is now the National Museum is the work of Norman Mitton, and a permanent tribute to his great talents; his Natural Habitat Groups are outstanding, and the perfection of his life-like casts of fish and reptiles unsurpassed; indeed the entire Museum bears the stamp of his genius. Not one to rest on his laurels, he was never satisfied with his achievements, and forever experimented with improved techniques and more satisfying display methods; in fact he was a great artist and a great all round naturalist, as well as a brilliant technician.

Norman Mitton was an exceptionally well read man with a wide range of interests covering literature, the theatre and visual arts as well as current scientific and technical developments. His outstanding talents and achievements, his unfailing generosity and attractive personality, earned him universal respect and popularity, and his untimely death will be a great personal loss to his many

friends, whose deepest sympathy goes out to his widow and children.

Norman Mitton's services to Kenya were outstanding and his loss to our National Museum is one that can never be made good.

R.H.C.

EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

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PRINTED IN EAST AFRICA BY AERAD LITHOGRAPHIC PRINTERS

JOURNAL

OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. XXVI No. 1 (113) **JUNE 1966**

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(Published 7/6/1967)

Price Shs. 20/-

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CYPERACEAE OF EAST AFRICA — IV

By

D. M. NAPPEP

CYPERUS L.

Cyperus is without doubt the largest genus ot sedges occurring in the tropics. Even in the narrower interpretations of the genus such as the one used here several hundred species of the tropical and subtropical regions are included, many of which are pantropical. In East Africa *Cyperus* species are found in damp places and in water, but some also flourish in the short rainy season of the near desert areas; few have been recorded above 8,000 ft. except in the forest undergrowth, though from the sea shore to about 7,000 ft. they are abundant in all suitable habitats.

Though mostly leafy perennials of moderate size ranging from about 1 to 4 ft. high, a few species, including *C. papyrus,* are conspicuous for their great size, while others are conspicuous for the absence of foliage leaves, or their small very ephemeral or bulbous habit. The variety of form of rootstock and rhizome in the genus is striking and should be noted when material is being gathered, also, for rhizomatous or stoloniferous specimens, it should be noted whether the internodes are short or long and whether the stolons (where present) bear tubers or tunicate bulbs. Not all species with tunicate bulbs have the aerial stem and leaves arising directly from them; many have a short stolon growing out of the bulb which gives rise to the plant. Elongated pseudobulbs such as occur so commonly in *Mariscus* are not seen in *Cyperus* and help to separate these two genera at a point where inflorescence differences are minimal.

The inflorescence may be subtended by few or many leafy bracts, rarely there is only one looking like a continuation of the stem with the inflorescence apparently borne laterally. Though usually spreading and consisting of a simple or compound umbel of spikes there are a few species where the inflorescence is contracted into a simple head and the number of spikelets is correspondingly reduced. An exception to this is *C. pulchellus* in which the inflorescence closely resembles a *Kyllinga,* but the distichous and flattened spikelets with opposite instead of spirally arranged glumes as in the terete *Kyllinga* spikelets serve to separate them easily. The spikes of which the inflorescences are built up may be elongate with a rhachis much longer than the spikelets or digitate with the spikelets clustered at the tips of the peduncle. The spikelets themselves are few to many-flowered and normally comprise a basal pair of empty glumes with a series of distichously arranged fertile glumes above them in the axil of

each of which are the 3 stamens (sometimes only 1-2) with oblong or linear, rarely crested, anthers and an ovary which passes gradually into the simple style with a 3-fid stigma. In a few anomalous species the style is frequently 2-fid and the nutlet lenticular as in *Pycreus,* but such anomalous species may be distinguished by the orientation of the nutlet; in *Cyperus* it is dorso-ventrally compressed (the anterior angle of a normally trigonous nutlet is flattened and the flat side faces the rhachis) and in *Pycreus* it is laterally compressed (the edge of the nutlet is nearest the rhachis). The mature nutlets show little diversity of form or ornamentation, being for the most part smooth and ellipsoid-cylindric, with a triangular section. In a very few species the surface is warted or undulate (transversely waved) and some have a lenticular, not triangular, section as mentioned above.

The species designated as comprising *Juncellus* in the Flora of Tropical Africa vol. 8, and for which provision was made in the key to species in the first paper in the series, have here been included in *Cyperus.* Examination showed that most of them do not consistantly have 2-fid stigmas, the main point of deviation between the genera, and that there is less similarity between the species so grouped together than there is between each and the species of *Cyperus* with which they would be associated.

Certain marked omissions will be obvious on a comparison between the species given here and the account in the Flora of Tropical Africa. The affinity of these species is with *Mariscus* rather than *Cyperus* and they will be included in the next, and final, paper dealing with *Pycreus, Kyllinga* and *Mariscus* (including *Courtoisia*).

Key to Species

1. Inflorescence a solitary dense head (readily confused with *Mariscus* and *Kyllinga*) . . . 77
   Inflorescence spreading, branched, simple or compound (rarely a solitary spike) . . . 2
2. Inflorescence of one or more elongate spikes having a distinct, and often very long, rhachis . . . 3
   Inflorescence of short spikes of clustered or digitately arranged spikelets, rhachis scarcely discernable or absent . . . 49
3. Plants leafless, or with few, very short leaves . . . 4
   Plants leafy . . . 8
4. Stems terete, articulated . . . 5
   Stems not articulated . . . 6
5. Bracts almost as long as the inflorescences, with a few indistinct articulations . . . 11. *C. corymbosus*
   Bracts very short . . . 10. *C. articulatus*
6. Spikes shortly cylindric with numerous small spikelets . . . 1. *C. papyrus*
   Spikes broadly ovate . . . 7

7. Stem-bases coated with fibres; glumes 2.5-3 mm long . . 12. *C. schimperianus*
Stem-bases not surrounded by fibres; glumes 4-5 mm long . . . 9. *C. holstii*

8. Spikes long cylindric with numerous spikelets 9
Spikes shorter, broadly ovate with fewer spikelets or irregular in outline . . 17

9. Spikelets terete 10
Spikelets more or less compressed 11

10. Culms stout triangular not winged glumes obtuse . . . . . . 2. *C. grandis*
Culms more slender, triangular with winged angles; glumes subacute
3. *C. digitatus* var. *auricomus*

11. Spikelets rather turgid, inflated . . . . 8. *C. alopecuroides*
Spikelets flat 12

12. Spikelets distant . . . . 4. *C. exaltatus*
Spikelets crowded together 13

13. Spikes all sessile or subsessile 14
Spikes peduncled and sessile together 16

14. Glumes very small, scarcely over 1 mm long, acuminate . . 7. *C. imbricatus*
Glumes 1.5-2.5 mm long, obtuse or acute 15

15. Glumes obtuse, golden, 1.5-2 mm long . . . . 36. *C. iria*
Glumes acuminate, green or brown, 2-2.5 mm long . . . . 35. *C. eleusinoides*

16. Very robust plants with leaves over 20 mm wide; rays up to 10 ins. long
5. *C. immensus*
Stout plants with leaves less than 20 mm wide; rays up to 4 ins. long . . 6. *C. dives*

17. Spikelets quadrangular in section or subquadrangular 18
Spikelets terete or compressed 22

18. Annual; glumes 3-4 mm long . . . . 32. *C. zollingeri*
Perennials 19

19. Glumes dark grey-green . . . . 27. *C. maranguensis*
Glumes orange to dark red on the sides 20

20. All rays long, more or less equal . . . . 9. *C. holstii*
Rays unequal in length, some very short 21

21. Stems scabrid above . . . . 31. *C. schweinfurthianus*
Stems smooth throughout . . . . 30. *C. tenuiculmis*

22. Annual . . . . 28. *C. sphacelatus*
Perennials 23

23. Stems or stolens bearing bulbs 24
Bulbs absent, rhizome and stolons often tuberous 30

24. Stems distant from the bulbs, bulbs underground 25
Stems arising directly out of the bulbs which are often visible at ground level . 27

25. Bulbs large, 8-20 mm diam. at maturity; spikelets well spaced . . 22. *C. usitatus* var., *macrobulbus*
Bulbs rarely over 8 mm diam.; spikelets densely spicate 26

26. Bracts 2-3; bulbs brown . . . . 22. *C. usitatus* var. *usitatus*
Bracts 4-8; bulbs black . . . . 23. *C. stuhlmannii*

27. Stems slender; bracts very short; spike solitary . . . . . 26. *C. blysmoides*
Stems stouter; bracts 3-6, at least as long as the inflorescence; spikes several . . 28

28. Spikelets dark red, 10-20 mm long; rays up to 5 mm long . . 25. *C. bulbosus* var., *melanolepis*
Spikelets tawny, up to 10 mm long; rays short or absent 29

29. Spikes contracted almost into a head;
rays scarcely present . . . 24. *C. grandibulbosus* var. *grandibulbosus*
At least some of the spikes on well developed rays 24. *C. grandibulbosus* var. *amplus*

30. Stem-bases woody, tuberous, stolons usually stout; leaves never over 20 mm wide . 31
Stem-bases usually woody but not tuberous; leaves of some species over 20 mm wide 37

31. Nutlets strongly transversely ridged . . . 14. *C. undulatus*
Nutlets smooth . . . 32

32. Glumes whitish, 1-1.5 mm long . . . 16. *C. maculatus*
Glumes white, red, dark chestnut or black, 1.5-3 mm long . . . 33

33. Glumes whitish or red, up to 2.5 mm long . . . 34
Glumes black, rarely reddish, up to 3 mm long . . . 36

34. Glumes 1.5-2 mm long, white with dark patches on the sides . . . 15. *C. longus* var. *tenuiflorus*
Glumes 2-2.5 mm long; spikelets 1-1.5 mm wide . . . 35

35. Spikelets reddish . . . 15. *C. longus* var. *longus*
Spikelets whitish . . . 15. *C. longus* var. *pallidus*

36. Spikelets erect, crowded . . . 17. *C. rigidifolius*
Spikelets spreading, distant . . . 18. *C. kilimandscharicus*

37. Stolons present, usually long and slender, bearing tubers (on young plants look carefully for early signs of stolon development) . . . 38
Stolons absent, plants without tubers . . . 42

38. Spikelets turgid tumid or subcompressed . . . 40
Spikelets strongly compressed . . . 39

39. Plants slender; spikelets reddish brown, 1-2 mm wide . . . 19. *C. rotundus*
Plants more robust; spikelets black, 2.5 mm wide . . . 20. *C. merkeri*

40. Spikelets up to 2 mm wide . . . 41
Spikelets 2-2.5 mm wide . . . 19. *C. rotundus* ssp. *tuberosus*

41. Spikelets red . . . 19. *C. rotundus*
Spikelets orange . . . 21. *C. esculentus*

42. Spikelets terete; glumes rounded on the back . . . 43
Spikelets compressed; glumes mostly keeled on the back . . . 44

43. Spikelets very numerous, crowded; leaves over 25 mm wide . . . 13. *C. latifolius*
Spikelets few, distant; leaves under 12 mm wide . . . 29. *C. gracilinux*

44. Spikelets 3-5 mm wide . . . 45
Spikelets up to 2 mm wide . . . 46

45. Glumes pale throuoghout; spikelets compressed . . . 37. *C. compressus*
Glumes dark red on the sides; spikelets tumid . . . 38. *C. pustulatus*

46. Spikelets less than 1 mm wide . . . 33. *C. distans*
Spikelets over 1.5 mm wide . . . 47

47. Glumes golden or yellow, obtuse . . . 36. *C. iria*
Glumes black or brownish . . . 48

48. Glumes dark red with broad green keels . . . 34. *C. aterrimus*
Glumes light reddish brown . . . 35. *C. eleusinoides*

49. Perennials usually stout, with woody rhizomes and numerous leaves . . . 50
Annuals or slender-stemmed or leafless perennials . . . 60

50. Spikelets large, 10-20 mm long . . . 51
Spikelets up to 10 mm long . . . 52

51. Spikelets subterete, 2.5-3 mm wide, pale or brownish . . . 62. *C. maritimus*
Spikelets compressed, 3-5 mm wide, red . . . 63. *C. frerei*

52. Spikelets sharply keeled; glumes veined on the back only; bracts very long and very numerous . . . . 39. *C. alternifolius* ssp. *flabelliformis*
Spikelets often somewhat turgid; glumes never sharply keeled, veined on both back and sides 53

53. Glumes ovate when mature, up to 1.5 mm long 54
Glumes oblong 55

54. Culms up to 6 ft. high; spikelets 2-4 mm long . . . . . . 46. *C. renschii*
Culms up to 2 ft. high; spikelets 6-7 mm long; nutlets conspicuously protruding . . . . 45. *C. diffusus* var. *buchholzii*

55. Glumes acute, conspicuously mucronate 56
Glumes obtuse or minutely mucronate 59

56. Glumes up to 1.5 mm long; leaves 1-4 mm wide . . . . . 40. *C. ajax*
Glumes 2 mm long; leaves up to 2 cm wide 57

57. Spikelets plae greeny buff . . . . 43. *C. glaucophyllus*
Spikelets chestnut to dark red 58

58. Spikelets lanceolate . . . . 42. *C. pseudoleptocladus* var. *pseudoleptocladus*
Spikelets linear . . . . 42. *C. pseudoleptocladus* var. *polycarpus*

59. Leaves up to 1 in. wide; glumes closely overlapping, 2-2.5 mm long, minutely mucronate or emucronate . . . . 41. *C. dereilema*
Leaves up to ½ in. wide but usually less; glumes distant; 1.5-2 mm long, obtuse . . . . 44. *C. fischerianus*

60. Glumes obtuse, more or less furrowed, membranous; leaf-blades flat or absent . 61
Glumes truncate or subacute and mucronate but never obtuse, tougher; leaves narrow and channelled 74

61. Stems very stout, 2-6 mm wide; plants usually leafless 62
Stems narrower, up to 2 mm wide; leafy annuals or perennials or leafless perennials with stems not over 2 mm wide 65

62. Rays very numerous, equal . . . . 58. *C. prolifer*
Rays usually fewer, unequal 63

63. Spikelets linear, light brown or reddish, 8-10 mm long at maturity 57. *C. denudatus*
Spikelets narrowly lanceolate, light to dark red, up to 8 mm long at maturity . . 64

64. Spikelets reddish . . . . 56. *C. platycaulis* var. *platycaulis*
Spikelets shining dark blackish red . . . . 56. *C. platycaulis* var. *lucenti-nigricans*

65. Glumes dark; perennials 66
Glumes greenish tinged with orange, red or yellow; annuals or slender perennials 67

66. Plants very leafy; spikelets 2.5-4 mm long; glumes black with pale green keels . . . . . . 48. *C. dichroostachyus*
Leaves few or absent; spikelets 6-8 mm long; glumes dark red 55. *C. phæorrhizus*

67. Glumes with recurving mucros, often very short or with recurving tips . . . 68
Glumes emucronate or with a straight mucro 70

68. Leaves 8-10 mm wide . . . . 53. *C. foliaceus*
Leaves up to 4 mm wide 69

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1. *C. papyrus* L.
Leafless, stout-stemmed, rhizomatous perennial up to 18 ft. high. Inflorescence compound, spreading, with 1-2 cm long spikes of linear, narrow 6-10 mm long spikelets with green-keeled glumes. Rivers, dams, lakes, swamps, but always in water; 1,500-7,000 ft.
KENYA—Widespread.
TANGANYIKA—Widespread.
UGANDA—Widespread.

2. *C. grandis* C.B.Cl.
Stout perennial up to 6 ft. high with leaves ½-1¼ in. wide. Inflorescence large with numerous spikelets 8-18 mm long and over 1 mm wide in cylindric spikes 2-5 cm long; glumes ovate, obtuse. Swamps, sea level—500 ft.
KENYA—Coast.
TANGANYIKA—Coast.
ZANZIBAR—Zanzibar and Pemba Islands.

3. *C. digitatus* Roxb. ssp. *auricomus* (Spreng.) Kukenthal
(*C. auricomus* Sieber ex Spreng.)
Tufted perennial 1½-5 ft. high with numerous leaves ¼-¾ in. wide. Inflorescence large and spreading with numerous golden or reddish linear spikelets 10-20 mm long in loose cylindric spikes 2.5-6.5 cm long. River banks, seasonal and permanent swamps; 1,500-7,500 ft.
KENYA—Western, Rift Valley, Central Regions and Nairobi.
TANGANYIKA—Widespread in suitable places.
UGANDA—Western and Eastern Provinces.

4. *C. exaltatus* Retz.
Stout tufted perennial 1-4 ft. high with leaves up to ½ in. wide. Inflorescence large and compound with numerous distant compressed golden spikelets 4-10 mm long in cylindric spikes. Glumes ovate, obtuse, with a recurved mucro. In shallow water at the edge of dams, pools, lakes and rivers; sea level—6,000 ft.
KENYA—The coast and Nairobi.
TANGANYIKA—Northern, Tanga Regions and the coast.
ZANZIBAR—Zanzibar Island.

5. *C. immensus* C.B.Cl.
Large tufted perennial up to 8 ft. high with leaves ¾-1½ ins. wide. Inflorescence very large with numerous linear-lanceolate compressed spikelets 6-15 mm long in sessile or subsessile dense, broadly cylindric spikes. Glumes with a rigid conspicuous mucro and green keel. Rivers, swamps, dams and seasonally flooded places; 200-8,000 ft.
KENYA—Widespread.
TANGANYIKA—Widespread.
UGANDA—Buganda, and probably throughout the country.
ZANZIBAR—Zanzibar Island.

6. *C. dives* Del.
(*C. exaltatus* Retz. var. *dives* (Del.) C.B.Cl.)
Large tufted perennial up to 5 ft. high with leaves up to ¾ in. wide. Inflorescence large, with numerous compressed spikelets 4-8 mm long in dense cylindric spikes. Glumes with a short straight mucro. Differs from *C. immensus* chiefly in the smaller size, and from *C. imbricatus* by some or all of the spikes being pedunculate. Swamps; 2,000-6,000 ft.
KENYA—Widespread.
TANGANYIKA—Northern and Tanga Regions.
UGANDA—Western Province and Buganda.

7. *C. imbricatus* Retz.
(*C. radiatus* Vahl)
Stout tufted perennial 1½-4 ft. high with narrow leaves. Inflorescence of numeorus oblong-lanceolate compressed spikelets 3-7 mm long in dense sessile spikes. Glumes small, obtuse, greenish, with a short recurving mucro. Wet sandy places and river banks, uncommon; sea level—4,000 ft.
TANGANYIKA—Western and Southern Highland Regions and along the Rufiji River.
UGANDA—Western Province.

8. *C. alopecuroides* Rottb.
(*Juncellus alopecuroides* (Rottb.) C.B.Cl.)
Stout leafy perennial up to 5 ft. high. Inflorescence large with numerous lanceolate, acute, somewhat turgid spikelets 4-8 mm long in oblong cylindric spikes. Glumes 2-2.5 mm long, rounded on the back, tawny or greenish. Swamps, dams, rivers, usually in standing water; sea level—5,000 ft.
KENYA—Widespread but not common.
TANGANYIKA—Widespread in the northern part of the country.

9. *C. holstii* Kukenthal
(*C. zollingeri* var. *robusta* K. Schum.)
Tufted plant with long stout stolons, stout stems, and the leaves reduced to the sheaths only. Inflorescence large with numerous quadrangular tawny or light chestnut spikelets 15-40 mm long in subdigitate spikes of 3-8 spikelets. Glumes obtuse, 4-5 mm long. Damp grassland and swamps; sea level—800 ft.
KENYA—Coast.
TANGANYIKA—Coast.
The spikelets have a marked resemblance to *C. tenuiculmis* but the long and more numerous rays give the inflorescence a very different appearance.

10. *C. articulatus* L.
Leafless perennial with distant septate terete stems 2-6 ft. high. Inflorescence spreading with compressed spikelets 8-30 mm long. Glumes reddish, obtuse, green keeled. Dams, swamps, lakes; sea level—5,500 ft.
KENYA—Widespread.
TANGANYIKA-Widespread, and Mafia Island.
UGANDA—Widespread.
ZANZIBAR—Zanzibar Island.

11. *C. corymbosus* Rottb.
Very similar to *C. articulatus* but differs in the obscurely septate stems and the 2-4 scabrid-margined leaf-like bracts almost as long as the inflorescence. Rare in dams, swamps and lakes; 1,000-2,000 ft.
TANGANYIKA—Tanga Region.

12. *C. schimperianus* Steud.
Perennial 2-3 ft. high with trigonous or subterete stems surrounded by fibres at the base. Inflorescence with linear-oblong spikelets 8-18 mm long. Glumes distant, 2.5-3 mm long, rounded. Damp places, stream banks; 3,000-5,000 ft.
KENYA—Nairobi.
TANGANYIKA—Northern, Western and Tanga Regions.
UGANDA—Northern Province.

13. *C. latifolius* Poir.
Tufted perennial 1-6 ft. high. Leaves over 1 in. wide. Inflorescence large with broadly ovate dense spikes of 10-20 mm long spikelets. Glumes brown with conspicuous white margins. Swamps and wet places; 1,000-7,000 ft.
KENYA—Western, Central and Eastern Regions and Nairobi.
TANGANYIKA—Northern, Tanga, Western and Southern Highland Regions.
UGANDA—Western Province and Buganda.

14. *C. undulatus* Kukenthal
Stoloniferous perennial up to 2 ft. high with leaves $\frac{1}{4}$-$\frac{1}{2}$ in. wide. Inflorescence spreading with broadly ovate dense spikes. Spikelets spreading, linear, 10-25 mm long with obtuse, tawny glumes with white margins and green keels. Nutlets conspicuously transversely wrinkled. Damp and seasonally inundated places in dry bush and grassland; 1,000-3,500 ft.
KENYA—East of the Rift Valley, not common.
TANGANYIKA—Northern, Tanga and Eastern Regions.

15. *C. longus* L. var. *longus*
Tufted rhizomatous perennial up to 3 ft. high with scabrid-margined leaves. Inflorescence spreading with distant, suberect bright chestnut linear spikelets 10-25 mm long, up to 2 mm wide. Glumes 2-2.5 mm long, obtuse, with broad white margins. Seasonally inundated grassland; 1,000-4,000 ft.
KENYA—Northern Region.
TANGANYIKA—Tanga and Western Regions

var. *pallidus* Boeck.

This variety differs from the above only in the pale, off-white spikelets. Seasonally inundated places, very uncommon; 2,000-4,000 ft.
TANGANYIKA—Western Region.
UGANDA—Eastern Province.

var. *tenuiflorus* (Rottb.) Boeck.

Plant more slender than the above and rarely over 1-1½ ft. high. Spikelets linear, 10-25 mm long but only 1 mm wide, whitish but with chestnut patches on the sides and wide white margins. Near water, lake shores and river banks; 500-4,000 ft.
KENYA—Western Region.
TANGANYIKA—Lake, Northern, Western Regions and the Coast.
UGANDA—Western Province and Buganda.

16. *C. maculatus* Boeck.

Tufted perennial 1-1½ ft. high very similar to *C. longus* var. *tenuiflorus* but with much narrower leaves. Spikelets similar but shorter, 1 mm wide and lacking the dark patches of the above. Damp places and lake shores; 2,000-4,000 ft.
TANGANYIKA—Western Region.
UGANDA—Western Province.

17. *C. rigidifolius* Steud.

Stoloniferous perennial 4-12 ins. high with a stout woody rhizome. Inflorescence with numerous oblong-lanceolate spikelets 6-10 mm long, 2 mm wide, crowded into very dense ovate spikes, but often very reduced. Glumes dark red or black, green keeled. Damp places in grassland and near water; 4,000-11,000 ft.
KENYA—Widespread.
TANGANYIKA—Widespread, but less common towards the south.
UGANDA—Widespread.
There is considerable variation in the reduced forms normally included in this species and it is possible that a few of these should be ascribed to the rather similar *C. fissus.*

18. *C. kilimandscharicus* Kukenthal

Rhizomatous perennial 2-3 ft. high with tuberous-swollen culm-bases coated with fibrous sheath remnants. Inflorescence rather dense with oblong-lanceolate black spikelets 5-7 mm long, 2-2.5 mm wide, with shortly mucronate green keeled glumes 2.5-3 mm long. Seasonally swampy places, usually on black cotton soils; 3,500-5,500 ft.
KENYA—Central Region and Nairobi.
TANGANYIKA—Lake, Northern and Central Regions.

19. *C. rotundus* L.

Very variable perennial 6 ins.-2 ft. high with slender stolons bearing tubers. Inflorescence spreading with linear-lanceolate compressed or terete spikelets 10-20 mm long, 2-2.5 mm wide in short ovate spikes. Glumes ovate, acute or subobtuse, pale or dark red usually with a green keel and white margins. Grassland, swamps, damp places; sea level—6,000 ft.
KENYA—Widespread but not very abundant.
TANGANYIKA—Lake, Northern, Tanga, Western and Eastern Regions.
UGANDA—Widespread.
ZANZIBAR—Zanzibar and Pemba Islands.
Several subspecies and varieties have been described but the interpretation and synonymy of these is so complex that no attempt will be made here to distinguish them.

20. *C. merkeri* C.B.Cl.

(*C. rotundus* L. var, *spadiceus* Boeck., *C. rotundus* ssp. *merkeri* (C.B.Cl.) Kukenthal).

Tufted perennial 1½-2 ft. high. Stems often scarbrid. Inflorescence with strongly compressed spikelets 15-20 mm long, 2.5 mm wide, with dark red shining green-keeled glumes. Damp places in woodland and grassland; sea level—6,500 ft.
KENYA—Widespread.
TANGANYIKA—Widespread.
UGANDA—Western and Northern Provinces.
ZANZIBAR—Zanzibar Island.

21. *C. esculentus* L.

Perennial 4 ins.-1½ ft. high with slender tuber-bearing stolons. Inflorescence spreading, with ovate spikes of golden or tawny liner-oblong obtuse spikelets 5-12 mm long. Glumes

truncate, obtuse, rounded on the back. Seasonally swampy places, ditches and as a weed; sea level—7,000 ft.
KENYA—Widespread above about 4,500 ft.
TANGANYIKA—Widespread.
UGANDA—Western, Eastern Provinces and Buganda.
ZANZIBAR—Zanzibar Island.

22. *C. usitatus* Burch. var. *usitatus*
Small, single-stemmed plants up to 8 ins. high developed away from the bulb to which they are attached by a short slender stolon. Bulbs brown, shiny. Inflorescence simple, dense, 15-30 mm diam. with linear-lanceolate acute shining red spikelets 6-15 mm long, 2 mm wide. Glumes ovate, shortly mucronate. Grasslands, seasonally swampy places and as a weed; 3,500-6,000 ft.
KENYA—Rift Valley.
TANGANYIKA—Lake, Northern, Western and Central Regions.
UGANDA—Karamoja.

var. *macrobulbus* Kukenthal
Similar to the above except for its greater size, larger bulb etc. It is easily confused with the following species.
TANGANYIKA—Central Region.

23. *C. stuhlmannii* C.B.Cl.
Small plants up to 1 ft. high developed apart from the black 6-8 mm diam. bulbs. Inflorescence more ample than that of the above species, 12-18 mm diam. with linear-lanceolate acute spikelets 6-8 mm long, 2-2.5 mm wide. Glumes dark red subobtuse or acute. Grasslands and seasonally swampy places; 2,500-5,500 ft.
KENYA—Western Region and the Rift Valley.
TANGANYIKA—Lake Region.

24. *C. grandibulbosus* C.B.Cl. var *grandibulbosus*
Perennial up to 1½ ft. hgh with a solitary stem arising from a black 6-10 mm diam. bulb. Inflorescence contracted, with tawny-orange linear spikelets 8-10 mm long, 3 mm wide in a dense head. Sandy soils in seasonably damp places and on rocky outcrops; 1,500-4,500 ft.
KENYA—Northeastern, Eastern and Central Regions.
TANGANYIKA—Northern and Tanga Regions.

var. *amplus* Kukenthal
Plants larger than the above and the inflorescence spreading. Sandy soils in seasonally damp places; 1,500-4,500 ft.
KENYA—Northeastern and Eastern Regions.

25. *C. bulbosus* Vahl var. *melanolepis* Kukenthal
Perennial up to 1½ ft. high with a single stem arising out of a black or very dark brown bulb 6-10 mm wide. Inflorescence spreading with distant compressed spikelets 10-20 mm long, 1.5 mm wide, with dark red glumes. The inflorescence of this species is readily confused with *C. merkeri*, but the habit is very different. Damp places in dry grassland; 2,500-5,000 ft.
KENYA—Southern Region.
TANGANYIKA—Northern and Tanga Regions.

26. *C. blysmoides* C.B.Cl.
(*C. bulbosus* Vahl var. *spicatus* Boeck., *C. blysmoides* Hochst. nom. nud.)
Stems 4-12 ins. high arising directly out of a black bulb. Inflorescence a single spike without bracts, of 3-6 linear spikelets 8-12 mm long. Glumes shortly mucronate, dark red or pale. Weed, usually in damp places; 1,500-6,000 ft.
KENYA—Northern, Rift Valley, Central and Eastern Regions and Nairobi.
TANGANYIKA—Northern and Tanga Regions.

27. *C. maranguensis* K. Schum.
Tufted perennial up to 3 ft. high. Inflorescence of broadly ovate spikes of dark grey-green linear spikelets 15-20 mm long, 1.5 mm wide. Glumes elliptic obtuse. Upland and mountain forests; 2,000-7,000 ft.
KENYA—Northern and Central Regions and Nairobi.
TANGANYIKA—Northern, Tanga and Eastern Regions.
UGANDA—Buganda.

28. *C. sphacelatus* Rottb.
Tufted annual up to 2 ft. high. Inflorescence rather scanty with distant linear-lanceolate acute greyish-yellow spikelets 6-20 mm long, 1.5 mm wide. Glumes obtuse, green-keeled with white margins. Woodland and damp places; 1,000-4,000 ft.
TANGANYIKA—Lake, Western and Southern Regions.
UGANDA—Buganda.

29. *C. gracilinux* C.B.Cl.
Stoloniferous perennial 9 ins.-1½ ft. high. Inflorescence rather scanty with spreading linear-lanceolate acute spikelets 16-24 mm long, 2 mm wide. Glumes subobtuse, reddish with white hyaline margins and green keels. Seasonally swampy places, vlei; sea level—2,000 ft.
TANGANYIKA—Tanga Region.

30. *C. tenuiculmis* Boeck.
(*C. zollingeri* non Steud.)
Tufted perennial 8 ins.-3 ft. high with short stolons and swollen stem-bases. Inflorescence simple, with yellow or reddish linear acute spikelets 15-20 mm long and 3 mm wide. Glumes distant, obtuse, green-keeled. Grassland, woodland and damp places; 3,000-6,000 ft.
KENYA—Western Region.
TANGANYIKA—Western and Central Regions.
UGANDA—Western Province and Buganda.

31. *C. schweinfurthianus* Boeck.
(*C. zollingeri* auctt. var. *schweinfurthianus* (Boeck.) Kukenthal)
Perennial very similar to the above but the scabrous stems, and spikelets up to 30 mm long, 2.5 mm wide. Woodland, swamps and damp places; 3,000-5,000 ft.
TANGANYIKA—Western and Southern Highland Regions.
UGANDA—Western and Eastern Provinces.

32. *C. zollingeri* Steud.
(*C. rubroviridis* Cherm., *C. sphacelatus* var. *tenuior* C.B.Cl.)
Annual 6-12 ins. high. Inflorescence simple, spreading or contracted with short dense spikes. Spikelets linear-lanceolate, subquadrangular, 8-30 mm long, 1.5-2 mm wide, with distant glumes 3-4 mm long. Damp places, stream banks, and grasslands; sea level—500 ft.
KENYA—Coast.
TANGANYIKA—Coast.
ZANZIBAR—Zanzibar Island.

33. *C. distans* L.f.
(Including *C. ferrugineo-viridis* var. *distantiformis* Kukenthal in part)
Tufted perennial 1-3 ft. high with scabrid-margined leaves. Inflorescence large and spreading with dense spikes of dark spikelets obliquely spreading at first, becoming reflexed. Spikelets dark red or black, 10-20 mm long, less than 1 mm wide, with distant obtuse glumes with a rounded green back becoming spreading at maturity. Damp places, stream banks, lake shores and rivers; sea level—8,000 ft.
KENYA—Widespread.
TANGANYIKA—Widespread.
UGANDA—Widespread.
ZANZIBAR—Zanzibar and Pemba Islands.

34. *C. aterrimus* Steud.
Tufted perennial up to 4 ft. high with scabrid margined leaves. Inflorescence large, spreading, with black erect linear-lanceolate spikelets 10-20 mm long, 2 mm wide, with distant, keeled, obtuse glumes. In mist and mountain forests, damp places and seasonally flooded grassland; 3,500-10,000 ft.
KENYA—Widespread but not common.
TANGANYIKA—Widespread but not common.
UGANDA—Western Province.

35. *C. eleusinoides* Kunth
Perennial up to 4 ft. high with woody rhizome. Inflorescence large, with dense spikes of greeny-brown linear-oblong, acute spikelets 4-8 mm long. Glumes ovate-elliptic, mucronate, 2 mm long. Locally common on river banks and in swampy places; 3,000-4,500 ft.
UGANDA—Karamoja and the Eastern Province.

36. *C. iria* L.
Tufted perennial up to 2 ft. high. Inflorescence simple or compound with oblong compressed, obtuse, golden or yellow spikelets 5-10 mm long, in ovate or ovate-oblong short spikes. Glumes distant, broadly ovate, green-keeled, rounded, 1-1.5 mm long. Swamps, dams and ponds, rare; 3,000-4,500 ft.
KENYA—Western Region.
TANGANYIKA—Northern Region.

37. *C. compressus* L.
Tufted annual 6 ins.-1½ ft. high. Inflorescence simple, often contracted, with subdigitately arranged linear-oblong spikelets 10-20 mm long, 2.5-4 mm wide, with closely overlapped ovate, conspicuously mucronate glumes. Swamps and damp places, often in standing water; sea level—3,000 ft.
KENYA—Northeastern Region and the Coast.
TANGANYIKA—Lake, Tanga and Southern Regions and the Coast.
ZANZIBAR—Zanzibar Island.

38. *C. pustulatus* Vahl
Tufted annual 1-1½ ft. high. Spikelets subterete, 6-12 mm long, 3-3.5 mm wide, in very short or subdigitate spikes. Glumes rounded, obtuse, grey-green streaked with red. Stream banks, swampy places; 3,500-4,500 ft.
TANGANYIKA—Lake and Western Regions.

39. *C. alternifolius* L. ssp. *flabelliformis* (Rottb.) Kukenthal
Tufted leafless perennial 1½-6 ft. high. Inflorescence spreading with numerous leaflike bracts partially concealing the small clusters of 3-7 pale or brownish linear-oblong spikelets 5-8 mm long 1.5-2 mm wide. Damp places, swamps and stream banks; sea level—5,000 ft.
KENYA—Widespread.
TANGANYIKA—Widespread.
UGANDA—Widespread.
ZANZIBAR—Zanzibar and Pemba Islands.

40. *C. ajax* C.B.Cl.
Stout perennial 3-5 ft. high with leaves up to 1¾ ins. wide. Inflorescence large with ovate or oblong-lanceolate reddish spikelets 2-5 mm long, in clusters of 3-5. Glumes conspicuously mucronate 1.5 mm long. Mountain and bamboo forests; 2,000-10,000 ft.
KENYA—Mountains over 7,000 ft.
TANGANYIKA—Northern, Tanga and Southern Highland Regions.
UGANDA—Western Province.

41. *C. dereilema* Steud.
(*C. deckenii* Boeck., *C. dereilema* ssp. *deckenii* (Boeck.) Kukenthal)
Stout perennial 3-5 ft. high with leaves up to 1 in. wide. Inflorescence large with digitate clusters of ovate-lanceolate spikelets 4-10 mm long, 2-2.5 mm wide. Glumes tawny, brown, or dark red, obtuse. Many of the specimens examined show the tendency to leafy proliferation of the inflorescence common in most species of this group (species 40-46). Bamboo and mountain forests; 6,000-10,000 ft.
KENYA—Widespread.
TANGANYIKA—All upland areas.
UGANDA—All upland areas.

42. *C. pseudoleptocladus* Kukenthal var. *pseudoleptocladus*
(Including *C. deckenii* C.B.Cl., not of Boeck.)
Stout leafy perennial rather similar to the above but with leaves ¼-½ in. wide. Inflorescence dense with oblong-ovate spikelets 5-10 mm long, 1.5-2 mm wide. Glumes 2 mm long, brown or green conspicuously mucronate. Swamps and forests; 3,000-7,000 ft.
KENYA—Eastern Region.
TANGANYIKA—Northern, Tanga and Eastern Regions.
UGANDA—Western and Eastern Provinces and Buganda.

var. *polycarpus* Kukenthal
Differs from the above in the more branched and less crowded inflorescence and the slightly larger, narrower and darker spikelets. Locally abundant in open places; 3,000-8,000 ft.
KENYA—Western, Rift Valley, Northern and Eastern Regions.
TANGANYIKA—Kilimanjaro and the Usambara Mts.
UGANDA—Eastern Province.

43. *C. glaucophyllus* Boeck.
Stout perennial up to 3 ft. high with leaves less than ½ in. wide. Inflorescence large with solitary or clustered oblong-linear pale greenish spikelets 4-15 mm long, 1.5-2 mm wide. Glumes obovate, mucronate. Very similar to *C. dereilema* except for the spikelets. Forest; 3,000-7,000 ft.
TANGANYIKA—Pare and Usambara Mts.
UGANDA—Western Province.

44. *C. fischerianus* A. Rich.
Tufted perennial 1-3 ft. high with scabrid-margined leaves less than ½ in. wide. Inflorescence large, compound, with oblong-lanceolate spikelets 4-6 mm long, 1.5-2 mm wide. Glumes ovate-oblong, reddish with a green keel, obtuse. Inflorescence usually proliferating and arching down to the ground and taking root. Mountain forest; 4,000-8,000 ft.
KENYA—All Highland areas.
TANGANYIKA—Kilimanjaro.
UGANDA—All mountain ranges.

45. *C. diffusus* Vahl ssp. *buchholzii* (Boeck.) Kukenthal
Tufted perennial 1-2 ft. high, rather slender. Inflorescence large with brownish spikelets 6-7 mm long, 2-2.5 mm wide. Glumes with recurved mucros. Nutlets protruding conspicuously except from very immature spikelets. Damp places in dense bush and forest; 1,000-7,000 ft.
KENYA—Western and Rift Valley Regions.
TANGANYIKA—Western, Central and Tanga Regions.
UGANDA—Western, Eastern Provinces and Buganda.

46. *C. renschii* Boeck.
Tufted perennial up to 6 ft. high with leaves up to 1 in. wide. Inflorescence large with ovate spikelets 2-4 mm long. Glumes green, 1 mm long, with a recurved mucro. Forest clearings; sea level—7,000 ft.
KENYA—Coast, Southern Region.
TANGANYIKA—Widespread.
UGANDA—Western Province.
ZANZIBAR—Zanzibar Island.

47. *C. mapanioides* C.B.Cl. var. *major* (Boeck.) Kukenthal
(*C. dichromenaeformis* Kunth var. *major* Boeck.)
Tufted perennial 1-2 ft. high with stems somewhat swollen at the base. Inflorescence a simple contracted globose whitish head of compressed spikelets 6-14 mm long, 2.5-3.5 mm wide. Forests; 3,000-6,000 ft.
KENYA—Elgon.
TANGANYIKA—Western Region.
UGANDA—Sese Islands, Buganda.

48. *C. dichroostachyus* Hochst.
Tufted perennial 1-3 ft. high, with long stolons. Inflorescence rather dense with dark spikelets 2.5-4 mm long, 1-1.5 mm wide. Glumes black with broad, light green keels. Swampy places, stream banks dams; 4,000-8,000 ft.
KENYA—Widespread.
TANGANYIKA—Widespread, but more common in the north.
UGANDA—Western Province.

49. *C. difformis* L.
Erect perennial 9 ins.-1½ ft. high, often flowering as an annual. Inflorescence with numerous spikelets congested into dense greenish or red globose heads 6-12 mm diam. Spikelets 4-8 mm long, up to 1.5 mm wide. Dams, rivers, swampy places and seepage zones on rocky outcrops; sea level—5,500 ft.
KENYA—Western, Central and Southern Regions, Nairobi and the Coast.
TANGANYIKA—Widespread in the northern part of the country.
UGANDA—Western and Eastern Provinces and Buganda.

50. *C. reduncus* Boeck.
Annual 4-12 ins. high. Inflorescence of clustered pale green spikelets 5-10 mm long, 3-4 mm wide, with oblong-lanceolate recurving glumes. Swamps and rivers; 3,000-4,000 ft.
UGANDA—Buganda and Eastern Province.

51. *C. submicrolepis* Kukenthal
(*C. microlepis* C.B.Cl. non Baker).
Tufted annual 2-12 ins. high. Inflorescence of greenish clustered spikelets up to 4 mm long, 1.5 mm wide. Glumes obovate, closely overlapping. Poor shallow soils on rocky outcrops; 3,000-4,000 ft.
UGANDA—Buganda.

52. *C. tenuispica* Steud.
(*C. flavidus* C.B.Cl.)
Slender densely tufted ephemeral with yellowish leaves. Inflorescence of rather yellowish spikelets 4-12 mm long with spreading truncate glumes less than 1 mm long. Swampy places; sea level—3,500 ft.
TANGANYIKA—Northern, Tanga, Western, Eastern, Southern Regions and Mafia Island.
UGANDA—Buganda.
ZANZIBAR—Zanzibar Island.

53. *C. foliaceus* C.B.Cl.
Slender annual similar to the above, 1 ft. high. Spikelets 5-8 mm long, 1 mm wide, with truncate glumes 1.5 mm long. Stream banks; 500-4,000 ft.
KENYA—Coast.
TANGANYIKA—Tanga and Southern Regions.
UGANDA—Buganda.

54. *C. haspan* L.
(*C. cancellatus* Ridl.)
Slender stoloniferous perennial up to 1½ ft. high with short leaves or leafless. Inflorescence branched, with clustered spikelets 5-10 mm long, 1 mm wide. Glumes 1-1.5 mm long, shortly mucronate. Standing water, swamps, ditches, rivers; sea level—5,500 ft.
KENYA—Western, Eastern and Coast Regions.
TANGANYIKA—Widespread, especially in the north.
UGANDA—Western and Eastern Provinces and Buganda.

55. *C. phæorrhizus* K. Schum,
Slender perennial up to 1½ ft. high. Inflorescence simple, of dark red shining spikelets 6-8 mm long with ovate-oblong truncate glumes. Dams, rivers, seasonally swampy places and seepage zones; 3,500-10,000 ft.
KENYA—Widespread.
TANGANYIKA—Widespread, especially in the north.
UGANDA—Widespread.

56. *C. platycaulis* Baker var. *platycaulis*
(*C. denudatus* var. *platycaulis* C.B.Cl.)
Leafless perennial 1-3 ft. high with a stout woody rhizome and 3-winged stems. Inflorescence dense with numerous red spikelets 5-8 mm long, up to 1 mm wide, with small obtuse glumes. Very similar to *C. denudatus*. Streams, lake shores, dams; sea level—8,000 ft.
KENYA—Central Region and the Coast.
TANGANYIKA—Lake, Northern, Tanga and Western Regions.
There is much confusion over the precise limits of this species, and it is possible that most of the above localities refer to the following variety which is much more abundant in East Africa.

var. *lucenti-nigricans* (K. Schum.) Kukenth.
Leafless perennial with clums up to 8 mm wide. Inflorescence similar to the above but with dark red or black shining glumes. Swamps, dams and lake shores; 5,000-10,000 ft.
KENYA—Widespread. Western, Rift Valley, Central and Southern Regions and Nairobi.
TANGANYIKA—Widespread.
UGANDA—Western Province.

57. *C. denudatus* L.f.
Leafless perennial 1-3 ft. high with triangular stems and creeping rhizome. Inflorescence similar to the above species, but the spikelets 8-10 mm long, up to 2 mm wide, with ovate-lanceolate glumes. Lake shores, streams, swamps and seasonally flooded places; sea level—7,000 ft.
KENYA—Central, Eastern and Coast Regions.

TANGANYIKA—Widespread in the north of the country.
UGANDA—Western Province.
ZANZIBAR—Zanzibar Island.
There has been much confusion between *C. denudatus, C. phæorrhizus* and *C. platycaulis* var. *lucenti-nigricans* and they are possibly not all specifically distinct.

58. *C. prolifer* Lam.
Rhizomatous leafless perennial 1-3 ft. high with terete or 3-sided stems. Inflorescence umbellate with equal rays, usually proliferating. Spikelets linear, 6-12 mm long, 1 mm wide with obtuse, light red glumes. Swamps, seasonally flooded places and standing water, looking like a small papyrus; sea level—1,500 ft.
KENYA—Southern Region and the Coast.
TANGANYIKA—Eastern, Southern Highland and Southern Regions and the Coast.
ZANZIBAR—Zanzibar Island.

59. *C. tenax* Boeck, var. *tenax*
(*C. grantii* C.B.Cl.)
Tufted leafy perennial 3-12 ins. high with glaucous, coriaceous leaves crowded at the base. Inflorescence spreading with red or dark chestnut spikelets 6-12 mm long, 1-1.5 mm wide. Glumes obtuse, green-keeled. Sandy soils in bush and damp places; sea level—3,000 ft.
KENYA—Eastern Region and the Coast.
TANGANYIKA—Southern Region, the Coast and Mafia Island.
ZANZIBAR—Zanzibar and Pemba Island.

var. *pseudocastaneus* (Kukenthal) Kukenthal
(*C. boehmii* Boeck.)
Differs only in the darker spikelets and the more distant, spreading glumes. Thicket and woodland on sandy soils, damp places; 3,500-6,000 ft.
TANGANYIKA—Lake, Western, Central and Southern Highland Regions.
UGANDA—Western Province.

60. *C. cuspidatus* H.B.K.
Slender annual 2-6 ins. high with filiform leaves. Inflorescence of shortly pedunculate clusters often reduced to sessile, clusters appearing lateral to the bract. Spikelets chestnut 8-15 mm long, linear, with long-mucronate recurving glumes. Damp places, seepage zones on rocky outcrops; sea level—4,500 ft.
KENYA—Northern and Eastern Regions.
UGANDA—Buganda and Eastern Province.
ZANZIBAR—Pemba Island.
This species can easily be confused with slender plants of *Mariscus maderaspatanus.*

61. *C. amabilis* Vahl
Slender annual 2-10 ins. high with few leaves. Inflorescences of linear orange or brown spikelets 8-18 mm long, 1 mm wide. Seepage zones on rocky outcrops, lake shores and swampy places; sea level—5,000 ft.
KENYA—Northern, Rift Valley, Southern Regions and the Coast.
TANGANYIKA—Northern, Tanga, Western, Central and Southern Regions and the Coast.
UGANDA—Eastern Province.
ZANZIBAR—Zanzibar Island.

62. *C. maritimus* Poir.
Stout leafy perennial up to 1 ft. high. Inflorescence rather dense with oblong-lanceolate spikelets 12-30 mm long, 3-4 mm wide, with crowded obtuse glumes. Dry sandy places on river banks and the sea shore; sea level—500 ft.
KENYA—Coast.
TANGANYIKA—Coast and Mafia Island.
ZANZIBAR—Zanzibar Island.

63. *C. frerei* C.B.Cl.
Rhizomatous perennial 1 ft. high with narrower leaves than *C. maritimus.* Inflorescence dense 1-2 ins. diam., or occasionally with rays up to 2 ins. long. Spikelets cinnamon or reddish-purple, 16-40 mm long, 3-5 mm wide. Sandy damp places; sea level.
KENYA—Coast.

64. *C. chordorrhizus* Chiov.
Low-growing perennial with a slender branched rhizome. Lateral shoots long, sterile, with semiterete glaucous leaves 1-2 ins. long crowded at the tips. Terminal shoots short, fertile, with leaves up to ½ in. long. Inflorescence capitate, 4-6 mm wide with bracts dilated at the base. Spikelets ovate-lanceolate, 3-7 mm long with whitish glumes. Coastal sand dunes; sea level.
KENYA—Coast.

65. *C. laevigatus* L.
(*Juncellus laevigatus* (L.) C.B.Cl.)
Rhizomatous perennial up to 2 ft. high with stout leafless stems. Inflorescence a contracted, pseudolateral head of pale or dark spikelets 5-20 mm long, 2-2.5 mm wide. Glumes rounded on the back, 3 mm long. Swamps, lake shores and dams; sea level—6,500 ft.
KENYA—Widespread.
TANGANYIKA—Lake, Northern and Western Regions.
UGANDA—Western Province.

66. *C. pulchellus* R. Br.
(*C. leucocephalus* Nees non Retz.)
Tufted perennial up to 1½ ft. high with bulbous-based stems. Bracts reflexed. Inflorescence a dense globose head 5-8 mm diam. of whitish or cinnamon coloured compressed spikelets 3-6 mm long, 2-3 mm wide. Glumes at the base of the spikelets falling early. Swamps and damp places; sea level—5,000 ft.
KENYA—Eastern Region and the Coast.
TANGANYIKA—Western Region.

67. *C. angolensis* Boeck.
Sparingly leafy perennial 4 ins.-2 ft. high. Rhizome woody with long internodes and the stems bulbous based. Inflorescence a dense whitish hemispheric head up to 25 mm diam., the spikelets often purple tipped. Bush, open forest where burning is frequent; 2,000-9,000 ft.
TANGANYIKA—Western, Southern Highland and Southern Regions.
UGANDA—Imatong Mts.

68. *C. margaritaceus* Vahl
Slender culmed perennial up to 2 ft. high. Stems with swollen bases on a woody rhizome. Spikelets few, usually 3-7, in a dense head, oblong ovate, up to 20 mm long, 8-10 mm wide. Glumes loosely overlapped usually rather shiny. Similar to *C. obtusiflorus* but most uncommon. Open bush and sandy places; sea level—1,000 ft.
KENYA—Coast.
TANGANYIKA—Western Region and the Coast.
ZANZIBAR—Zanzibar Island.
Various varieties have been recorded in East Africa which, from the descriptions, seem scarcely distinguishable from the more robust form of *C. obtusiflorus*. In the absence of type material of these two species and their numerous forms it has not been possible to distinguish fully between them.

69. *C. obtusiflorus* Vahl
(*C. compactus* Vahl)
Leafy perennial up to 1 ft. high. Stems with swollen bases. Inflorescence a dense hemispheric head 15-20 mm wide with crowded, obtuse compressed spikelets 8-12 mm long, 4-8 mm wide. Glumes obtuse white. Woodland, rocky grassland, damp places, always on sandy soils; sea level—6,500 ft.
KENYA—Widespread.
TANGANYIKA—Widespread.
UGANDA—Widespread.
ZANZIBAR—Zanzibar Island.

70. *C. colymbetes* Kotschy & Peyr.
Leafless perennial up to 2 ft. high with stout sharply triangular stems 2-4 mm wide. Bract solitary as long as the dense 10-30 mm diam. head. Spikelets pale, lanceolate, 8-14 mm long, 6-8 mm wide, compressed. Styles occasionally bifid. In standing water, dams, swamps etc.; 2,000-4,000 ft.
KENYA—Western Region.
TANGANYIKA—Tanga Region.
UGANDA—Western Province.

71. *C. nudicaulis* Poir.

Leafless perennial 1-2 ft. high with slender obtuse-angled stems. Bracts 2, scarcely exceeding the dense head. Spikelets 8-20 mm long, 4-5 mm wide with acute, tawny, green-keeled glumes. Styles 3—2-fid. Swamps and rivers; 3,000-6,500 ft.
KENYA—Western and Central Regions.
TANGANYIKA—Western and Tanga Regions.
UGANDA—Western Province.

72. *C. bellus* Kunth var. *tanganyicanus* Kukenthal

Slender tufted plants up to 5 ins. high becoming rather fibrous at the base. Inflorescence a solitary head of few compressed spikelets 8-12 mm long, 1-2 mm wide. Glumes brown, 2 mm long, with a conspicuous mucro. Rocky upland grassland; 2,500-7,000 ft.
TANGANYIKA—Western, Southern Highland and Southern Regions.

73. *C. kaessneri* C.B.Cl.

Annual 3-9 ins. high. Head dense, hemispheric, 10-25 mm diam. with linear-oblong obtuse spikelets 6-20 mm long, 2 mm wide. Glumes ovate, dark red but paling above. Open grassland, rock crevices, scrub; sea level—4,000 ft.
KENYA—Eastern and Coastal Regions.
TANGANYIKA—Tanga Region and the Coast.
UGANDA—Karamoja.

74. *C. teneriffae* Poir.

Tufted annual up to 9 ins. high somewhat bulbous at the base with membranous sheaths. Head dense, 10-20 mm diam. with 5-10 mm long spikelets broader than in the above species. Glumes purplish or reddish 2.5-5.5 mm long, with a recurved mucro. Damp grassland and seasonal pools; sea level—6,500 ft.
KENYA—Widespread.
TANGANYIKA—Lake, Northern and Tanga Regions.
UGANDA—Western Province and Karamoja.
ZANZIBAR—Zanzibar Island.

75. *C. pygmaeus* Rottb.

(*C. michelianus* (L.) Link subsp. *pygmaeus* (Rottb.) Aschers, & Graeb., *Juncellus pygmaeus* (Rottb.) C.B.Cl.)

Tufted annual up to 6 ins. high. Bracts 3-8, very long and spreading, dilated at the base. Head dense, 6-12 mm diam. with numerous spikelets 3-4 mm long. Glumes almost spirally arranged, lanceolate-ovate, 1-2 mm long. Damp sandy places; 1,000-4,000 ft.
KENYA—Eastern Region.
TANGANYIKA—Lake, Western and Southern Highland Regions.

(Received for publication 11th March, 1966)

NOTES ON THE BIRDS OF LENGETIA FARM, MAU NAROK

By

P. H. B. Sessions

Introduction

The following paper is the summary of five years observation and notes on the birds of this high-altitude mixed farm. The notes were made in order to resolve their status, distribution, breeding and migration dates, and the effect on them of the change-over from natural to agricultural conditions. From 1953, when the farm was first occupied, to 1960 only a very few notes were made, and this summary is mainly based on notes made during the following five years.

The 250 species listed have been identified from the farm either by sight or sound, except where instanced in the text. I have included a locally-extinct species, the Ostrich, as being of interest, although unlikely to re-occur. The title heading for each species, giving the English and scientific for the bird under reference, plus the names of any other bird mentioned in the text, follow Praed and Grant. Only the English names are normally used where these birds are also mentioned in the text. The nomenclature of those species not found in Praed and Grant is taken from Witherby.

Topography and Climate

Beyond the western wall of the central Rift Valley, 35 miles west of Gilgil, lies a high plateau, between 9,000 ft. and 10,000 ft. above sea-level. This plateau runs more or less north-west and south-east for about 50 miles, and consists of open grassland, wedged in by thick forest on either side; it is occupied mainly by Masai tribesmen and is virtually in its primaeval state. Traversing this open plain from east to west is the farming district of Mau Narok, about 12 miles long by 3 miles wide. This farmland has been intensively developed from its virgin state over the last 13 years mainly with cereal crops and exotic grass leys for sheep. Lengetia Farm lies at the western end of this district and consists of 1,900 acres of both flat and steeply ridged land. The south and west sides are bordered by cedar and olive forest, and the remainder is quite open; before 1953 the latter was covered with sour grasses and light bush, but now more than half is under crops and leys. Across the farm a number of windbreaks of pine and cypress have been planted. Three semi-permanent streams run north and south through the farm, and in the

middle of a flat waterlogged field lies a small dam of about an acre of water. The annual rainfall averages 41", the rainy periods occurring in April/May, heaviest in July/August, and again in November/December. The average shade temperature at noon is 70°F, and at night there is often a frost. The prevailing wind is from the east, and is fairly strong in the dry season. The climate is generally equable, and does not suffer the extremes that occur at lower altitudes.

The Habitats

The area contains four habitats (I) Forest, (II) Open Grassland, (III) Rocky Stream-beds and Lightly Wooded Valleys, and (IV) Aquatic.

(I) The Forest covers 200 acres along a two mile boundary being the edge of the main forest which lies inside the Masai Reserve. In fact many birds seem to prefer this edge of forest, which has been subjected to successive fires and where much secondary growth has arisen. Further in, where there is less ground cover, and less light penetrates the towering cedars, bird-life seems comparatively scarce. Over 50 of the resident species live in the forest edge habitat. The garden should be included here, as although it has been made a quarter of a mile from the forest, it has gradually attracted many species from there.

(II) The Open Grassland covers about 1,500 acres and is practically treeless. 20 species are resident or breed in this area, but it is a great attraction to migrants and birds of prey.

(III) The Rocky Stream-beds and lightly Wooded Valleys are the haunt of the Mackinder's Owl nightjars, Black Duck and Wryneck.

(IV) The Aquatic habitat consists of a dam set in an open windy marshland, this never-the-less has been the primary attraction for 45 species of birds.

The effect of cultivation does not seem to have an adverse action on any species, except the Capped Wheatear, and most birds which existed on the natural grasses seem to thrive even better on planted crops. The Ostrich, which has been locally exterminated, is more likely the victim of "civilisation" than of cultivation. Species unobserved before cultivation, which are beginning to colonise the farm include the Black-shouldered Kite, Ring-necked Dove and Pied Wagtail; other birds, especially certain species of sparrows and weavers not yet listed for the farm, are moving nearer each year.

Vegetation

The vegetation is divided sharply between the forest and open grassland; there is hardly any park-like land. The forest consists mainly of

cedar, *Juniperus procera* Hochst. ex Endl., and brown olive, *Olea africana* Mill., with a few Kenya olive, *O. hochstetteri* Baker; most of this timber is in a dry and over-mature state. There is hardly any bamboo, podo or mukeo, which all occur on the farms a few miles to the east, and are indicative of a slightly higher rainfall. The secondary growth along the edge of the forest consists of a large number of species of shrubs and small trees, as well as numerous young cedars. The grassland is composed mainly of short grasses flowering not more than 18″ high, together with some heather and light bush, such as *Berberis holstii* Engl., on the ridges where the soil is deeper. Where cattle were stockaded in the past, nettles, thistles and tussock grass cover the ground.

Migration

The large number of migratory birds, comprising some 50 species, seen regularly on passage, seem to indicate that this area lies across a definite migration route, possibly two routes. Flanked by thick forest, the Mau Narok belt of open land may act as a funnel for birds moving north and south, or east and west, especially as it includes a number of small dams which provide convenient resting places.

Breeding

Most of the small birds have their main breeding season in April/May, and the forest birds may breed again in November/December. The breeding dates are derived from any associated evidence, i.e. from display to the presence of fledglings, and refer roughly to the egg-laying period. The word "pair" is user rather loosely in the text, generally as opposed to "single" or "flock", rather than to denote "male and female".

Systematic List

OSTRICH, *Struthio camelus massaicus* Neum.

Formerly a resident, breeding locally between 9,000′ and 10,000′, according to a reliable Masai tribesman, Lunge Ole Kisaga, who has lived here for 50 years. He says they were seen in numbers up to a 100, away from the forest on the open grasslands. When I arrived in 1953, I found only a cock and two hens, and these were soon wantonly destroyed.

GREAT CRESTED GREBE, *Podiceps cristatus* Linnaeus.

Rare visitor to the dam: two records only, a single bird on 7.vi.63, and two birds on 4.xi.63.

LITTLE GREBE, *Poliocephalus ruficollis* (Pallas).

Resident, only absent for short spells. Found on the dam and sometimes on smaller pools; breeds, juveniles being seen in August. In April 1964, 15 birds stayed on the dam for 2 days, and were in every stage of plumage, from near-white immatures to almost black adults.

WHITE-NECKED CORMORANT, *Phalacrocorax carbo lugubris* Rüppell.
Passage migrant. Three records for October and December 1963, one bird being immature.

LONG-TAILED CORMORANT, *Phalacrocorax africanus* (Gmelin).
Uncommon passage migrant, but occurring most months.

[WHITE PELICAN, *Pelecanus onocrotalus* Linnaeus.]
A party of about a dozen birds seen over Lutyens' farm on 13.vii.65. The birds were really too high for us to distinguish the species, but this seemed the most likely.

GREY HERON, *Ardea cinerea* Linnaeus.
Occasional visitor to dam in winter months; immatures seen November 1960 and September 1965. Rather shyer than following species, and I consider they are mostly palæarctic migrants.

BLACK-HEADED HERON, *Ardea melanocephala* Vigors & Children.
Visitor, more frequent than the Grey Heron, although only singly as that species. Much more common, and seen in small flocks on farms a few miles to the east, where there is wetter land.

PURPLE HERON, *Pyrrherodia purpurea* (Linnaeus).
Uncommon visitor, although one immature bird stayed 6 months. Has been seen locally in small flocks.

GREAT WHITE EGRET, *Casmerodius albus* (Linnaeus).
Regular visitor, about alternate months, always singly, with yellow bill. Usually stays for one or two days only.

YELLOW-BILLED EGRET, *Mesophoyx intermedius* (Wagler).
Occasional visitor to dam, and is probably a passage migrant from the south, going north to breed, as all records are for the month of May.

BUFF-BACKED HERON, *Bubulcus ibis* (Linnaeus).
Regular annual passage migrant in small numbers in March and April, when a few birds are seen resting on their way north.

SQUACCO HERON, *Ardeola ralloides* (Scopoli).
One record for 17.xi.65, the bird staying for two days on the farm. The bird was heavily streaked with brown on its flanks, and may have been an immature, or even been *A. idae* (Hartlaub). It perched freely on tall cedar trees when disturbed.

GREEN-BACKED HERON, *Butorides striatus* (Linnaeus).
One record for October 1964. This was a pale bird, looking like a miniature Grey Heron; it had bright yellow legs, but the colour of the legs seems to vary, for the colour of legs of birds seen in Narok and Baringo were both different; no two textbooks give the same description, which may be due to marked seasonal variations.

HAMMERKOP, *Scopus umbretta* (Gmelin).
Visitor to dam and small pools; recorded for most months. Always singly. Usually very tame, and stays several days.

WHITE STORK, *Ciconia ciconia* (Linnaeus).
"Winter" visitor and passage migrant, with some birds staying on through June and July. In 1960, many of the birds that stayed behind appeared to be sick and dying, and observers from Molo reported the same thing; they may have eaten locusts or other insects killed by spraying. White Storks become most numerous in the New Year when ploughing starts, and they are generally to be seen following the tractors, sometimes lining the furrow for a hundred yards or more. They appear to exhaust the food supply of the fresh-turned soil quickly, and then stand patiently until the tractor returns. They eat mainly small flying and larval insects, although their prize catch is the mole-rat (*Tachyoryctes*), which, if they are allowed to keep, occupies them a quarter of an hour in trying to swallow. They make

no attempt to rob each other, but often lose their prey to Marabou Storks (*Leptoptilos*) and Steppe and Tawny Eagles (*Aquila rapax*) which are often at hand and take advantage of the Stork's tameness which allows it to approach within a few feet of the tractor and so find the mole-rats before they can dive beneath the furrow out of which the plough has just thrown them. At dusk the Storks roost either on an open field of short grass, or on the tops of the tall cedars on the edge of the forest; as they settle down for the night they indulge in some bill-clattering. There seems to be some danger in the ground roosting habit, as many birds have been found with broken legs (about a dozen on the farm last year) and they may take off in the night when alarmed by a small predator such as a jackal, and fly into the wire fences. The frequency of these accidents must constitute a considerable factor in their death rate. In the morning they fly back to the working tractors about an hour after sunrise; if the tractor has moved into another field they go there directly, and I have seen them move low down from a ground roost to some new ploughing over a hill, which indicates they find their way by ear. From January to February there are about 200 birds on the farm, and probably 2,000 in the district. On a brilliant cloudless morning in March I have watched small parties from many farms joining up into a group of a 1,000 birds spiralling up on a thermal, the flock nearly disappearing out of sight overhead, before gliding off northwards at great speed.

BLACK STORK, *Ciconia nigra* (Linnaeus).

Rare "winter" visitor, recent dates being 13.ii.61, and 1.iii.61. Both were in pairs, and unaccompanied by other species.

WOOLLY-NECKED STORK, *Dissoura episcopus* (Boddaert).

One record of 50 to 60 birds flying east, 9.00 a.m., 27.xi.60, low over the house, into a strong wind, on a clear sunny day, when their white necks showed up clearly.

ABDIM'S STORK, *Sphenorynchus abdimii* (Lichtenstein).

A not uncommon visitor, only in the "winter" months, there being no records for May to October inclusive. Often in company with White Storks. By far the most common occurrences are in November and December, when it occurs in flocks up to 200.

OPEN-BILL, *Anastomus lamelligerus* Temminck.

On 29.xi.64. 150 to 200 birds flew eastwards over the farm about midday. They made their way into a strong wind by circling up until they were almost out of sight, then gliding down until they nearly reached the ground. Finally they must have picked up a more favourable wind, as they made a bee-line for the Rift Valley at a great height. Again on 18.xi.65, in company with Mr. Leslie Brown, I saw a large flock of nearly 400 birds 4 miles west of the farm; these also were flying due east, and the following day I saw another flock of 200. A few days previously several of these storks were actually seen resting on the farm.

SADDLE-BILL, *Ephippiorhynchus senegalensis* (Shaw).

Passage migrant: one record, 29.xi.60, bird flying low over farm eastward, 10.00 a.m. Also observed by others on dams to the east, up to 9,500 ft., at least three times.

MARABOU, *Leptoptilos crumeniferus* (Lesson).

Variable visitor, sometimes a few, sometimes many, at times staying for weeks, sometimes not seen for months. On 31.iii.53, several hundred roosted in cedar trees on farm. Often appear with White Storks, (q.v.), on which they prey, robbing them of the mole-rats they catch when following the plough. Appear at lambing time to feed on the afterbirth with vultures, but generally not often seen to eat carrion.

WOOD-IBIS, *Ibis ibis* (Linnaeus).

One immature bird visited dams on this and other farms from July to October 1963. Very shy.

SACRED IBIS, *Threskiornis aethiopicus* (Latham).

Occasional visitor to dam. Recorded January, March and April over 4 years. One to three birds at a time, staying only a day or so.

HADADA, *Hagedashia hagedash* (Latham).

Regular visitor, but resident and breeds locally. Nested on a dead tree overhanging a dam on a neighbouring farm, May 1962, the eggs being destroyed. Praed and Grant are

rather misleading in stating that birds seen over 7,000 ft. would be the Green Ibis, *Lampribis olivacea* (Dubus), as I have been unable to confirm the presence of this bird, while the Hadada is fairly common between here and Molo at 9,000 ft. However our Hadada do seem much darker than birds of this species seen at lower altitudes.

AFRICAN SPOONBILL, *Platalea alba* Scopoli.

One bird seen beside the dam on 20.x.65.

LESSER FLAMINGO, *Phoeniconaias minor* (Geoffroy).

Occasional weak birds fall from migrating flocks; this occurred especially in 1961 when many lakes were dry, and birds drifted about all over the Rift Valley, some being picked up dead in tiny pools on mountain streams. I have occasionally heard large flocks passing overhead at night, and from the sound I judged them to be travelling north or south. From the map it would seem that these birds do not necessarily follow the line of the Rift Valley Lakes when moving to another feeding ground, but may take a more direct overland route.

AFRICAN POCHARD, *Aythya erythrophthalma* (Wied).

Occasional visitor, especially in years 1954-1956, lately only seldom, perhaps one or two a year.

SHOVELER, *Spatula clypeata* (Linnaeus).

Occasional winter visitor between November and February; singly or in pairs.

YELLOW-BILLED DUCK, *Anas undulata* Dubois.

Commonest duck found on the dam, most months; generally a pair, but up to 26 seen. Not found to breed, but may do so when surrounding cover grows.

BLACK DUCK, *Anas sparsa* Eyton.

Probably resident, but difficult to find at times, as during the dry weather it retires into the forest. Newly hatched ducklings seen locally September 1963, and a family party of 8 including ¾-grown birds on 18.vi.61. Otherwise only seen singly or in pairs.

WIGEON, *Anas penelope* Linnaeus.

Two birds in a large mixed pack of duck on dam, October 1962.

GARGANEY, *Anas querquedula* Linnaeus.

Three records: a pair in November 1962, a pair in October 1963, and a single bird that stayed for two weeks in December 1964.

CAPE WIGEON, *Anas capensis* Gmelin.

One bird, 12.iii.65.

HOTTENTOT TEAL, *Anas punctata* Burchell.

Three single records, September and December 1960, and April 1961.

RED-BILL, *Anas erythrorhyncha* Gmelin.

Common visitor 1954-1956, now only rarely, about twice a year, in pairs or small parties. Usually seen with Yellow-bills.

PINTAIL, *Anas acuta* Linnaeus.

Two records, 18.xi.63 and 1.i.65, the second being for a male and female.

FULVOUS TREE-DUCK, *Dendocygna bicolor* (Vieillot).

Three records, all single birds; May, November and December.

KNOB-BILLED GOOSE, *Sarkidiornis melanotos* (Pennant).

Uncommon visitor.

EGYPTIAN GOOSE, *Alopochen aegyptiacus* (Linnaeus).

Irregular visitor, which bred once. About 6 months after the dam had filled for the first time, a pair hatched 5 goslings, mid-October 1954, all of them surviving and leaving December 13th. Seen occasionally in singles, pairs or parties up to 15, usually March/April and October/December.

SPUR-WINGED GOOSE, *Plectropterus gambensis* (Linnaeus).

Rare visitor, with one record for 8.ix.61, and two or three birds seen on local dams.

SECRETARY BIRD, *Sagittarius serpentarius* (Miller).

Resident in the district. Has bred on the farm once, when two young were reared from a nest on a low flat topped cedar tree in a river valley. Birds sitting on eggs have been seen in March and September. What appeared to be a display was observed when two birds circled about 150 ft., above the house, one of them making a loud, deep, creaking noise, quite unlike any other bird sound; this may be compared with Priest, p. 187. On another occasion I witnessed a Secretary Bird fly down a Snipe. The latter flew about a 100 yards at a time, dropping down into the tussock vlei grass, only to dart up as the Secretary Bird approached. Finally the Snipe left it too late, and the pursuer made a successful grab with its talons. When I arrived at the spot there was hardly a feather to be seen.

RUPPELL'S GRIFFON, *Gyps rüppellii* (Brehm).

Possibly the commonest vulture in the area, sometimes in mixed flocks, at other times by themselves in flocks of up to 50 birds. Roost in cedar trees, leaving in the morning about 10.00 a.m., to pick up a thermal, usually over a ploughed field. On a cold wet day, they often start off much earlier, flapping off in a long, leisurely line into the Masai reserve. The breeding status of the vultures has not been mentioned, as although they are seen all the year round, it is unlikly that any of them breed near here.

WHITE-BACKED VULTURE, *Pseudogyps africanus* (Salvadori).

Quite a common vulture which is seen most months, with up to 20 birds in a mixed flock of vultures. The white back is not easily seen, and the best identification is from the under-wing pattern.

LAPPET-FACED VULTURE, *Torgos tracheliotus* (Forster).

Generally only in pairs or singly in mixed flocks of vultures, but seen more regularly than other species.

WHITE-HEADED VULTURE, *Trigonoceps occipitalis* (Burchell).

Only two positive records, October and November 1962, in flight.

EGYPTIAN VULTURE, *Neophron percnopterus* (Linnaeus).

Three records; October/November 1962, and April 1963.

HOODED VULTURE, *Necrosyrtes monachus* (Temminck).

Fairly common, about 5 to 15 birds in a mixed vulture flock of 30 birds. The surrounding Masai country still provides a lot of carrion, due to the frequent deaths of the native cattle, the afterbirth from domestic stock, and the remains from hyena kills. About the only animal they seldom touch is a dead hyena itself; they can finish off an entire leopard carcase in an hour, although on occasions they will not touch that either.

[PEREGRINE, *Falco peregrinus* Tunstall.]

Typical peregrine type seen occasionally flying west, usually very fast, and obviating accurate identification. Most records have been for October, and November.

HOBBY, *Falco subbuteo* Linnaeus.

Winter passage migrant. Hobbies are seen fairly often but the speed at which they fly normally precludes naming of the species. Singly or in pairs. Mostly seen November, December and April, once September.

AFRICAN HOBBY, *Falco cuvieri* Smith.

Status uncertain, but rarely seen. I have watched it hunting the Black-winged Plover, by quartering the ground at great speed, causing the plovers to take off, but have yet to see it make a kill.

EASTERN RED-FOOTED FALCON, *Falco amurensis* Radde.

Uncommon passage migrant. Records in November, December and April.

KESTREL, *Falco tinnunculus* Linnaeus.

Winter passage migrant, but generally not distinguished from the Lesser Kestrel. From the certain identifications made, it would appear that the latter is much the commoner. One bird was observed on the 8.vi.63, hovering overhead, and might well have been the ABYSSINIAN KESTREL, *F.t. carlo* (Hart & Neum).

LESSER KESTREL, *Falco naumanni* Fleischer.

Winter passage migrant, usually in small flocks of 6 to 20 birds. As with many of the European migrants, they are generally seen moving in an easterly or south-easterly direction on both the spring and autumn passages. Records for both species of Kestrels occur from October to April only, and they are seen mostly in these two months, with a slight increase of numbers again in December.

KITE, *Milvus migrans* (Boddaert).

Generally present on farm in small numbers, except for July and August when there are no records. In January and February they are found in flocks of from 20 to 30 birds, which drift around and retire to roost in cedars on the edge of the forest in the evening. I have not yet found their nests, but they may well breed here. A number of these birds have been definitely identified as the migratory European race, *M.m. migrans* (Bodd.), with black bills.

BLACK-SHOULDERED KITE, *Elanus caeruleus* (Desfontaines).

Occasional visitor. This is one of the birds that appears to be extending its range westwards with the increase of cultivation. It used to be observed regularly about 15 miles to the east, and in March 1962 it was seen three miles away. Six months later it was seen on the next farm, and a year later it was on this farm. Since then it has been seen with increasing frequency, though normally staying only for a week or so.

STEPPE/TAWNY EAGLE, *Aquila rapax* (Temminck).

Praed and Grant, in the amendments contained in their 1956 edition, have combined the Steppe and Tawny Eagles into one species, the Steppe being a migrant and winter visitor, and the Tawny a resident. Whether this is a valid arrangment or not, the two races appear to be distinct in the field. The Steppe Eagle, renamed *Aquila rapax orientalis* Cab, arrives around the second week of October, and may be recognised by the pale upper-tail coverts, which in the young bird look almost white; there is also a distinctive under-wing pattern which is formed by pale tips to the under-wing-coverts, and appears as a V across the wings. Sometimes these migrant Eagles are seen in numbers up to a dozen, and it seems hard to believe all these would be juveniles, and yet *all* of them will show the under-wing and upper-tail patterns, and distinguish the bird from the resident Tawny Eagle. Other characteristics include, of course, its habit of flocking, and also a more pronounced tendency to settle on the ground; I have not yet been able to separate their call notes. They spend much time in company with White Storks,waiting to rob them of mole-rats which the latter sometimes catch. The Steppe Eagle departs early in April.

The Tawny Eagle is a fairly common resident, which may undergo some local movement. There are probably two pairs on the farm, and they must nest at the turn of the year, as I usually see very young birds in April. There are at least three other pairs in Mau Narok, which all breed about the same time.

AFRICAN HAWK-EAGLE, *Hieraaetus spilogaster* (Bonaparte).

Uncommon visitor, which seldom gives enough time for sure identification. One bird dispersed an enormous flock of Pink-breasted Doves, which were feeding on some newly planted wheat seed, and which I had failed to move by gunshot. The next morning I found the remains of many dead doves scattered over the field, which I presumed had been killed by this Eagle.

AYRES' HAWK-EAGLE, *Hieraaetus dubius* (Smith).

One definite record, 9.viii.65, and possibly other occasions when confirmation was difficult. The white over the eye was a prominent field character.

MARTIAL EAGLE, *Polemaetus bellicosus* (Daudin).

Visitor, which probably breeds locally. Two juveniles were shot locally in July 1961 and May 1962, while stealing poultry. Another young bird was seen in August 1963. From the appearance of the young, sometimes seen with their parents, I would guess that they breed at the beginning of the year. I have only twice heard this bird call, each time from

the same place, and nearly two years apart. Once the bird was flying, the other time it was in a tree, flying off silently when disturbed. The call was high and flutey "hoy-yok hoy-yok hoy-yok" and distinct enough for me to remember after the two year gap. They do not appear to take carrion, as I have seen a bird follow vultures to a corpse, and return without feeding. Another one I saw in March 1953, alighted on the back of a White Stork, which was feeding in company with about a hundred others, and killed and ate it, with three Tawny Eagles watching from a few feet away. The Stork seemed quite healthy.

CROWNED HAWK-EAGLE, *Stephanoaetus coronatus* (Linnaeus).

Resident, breeds. One pair have a nest in an 80 ft. tall dead cedar about 800 yards below the house, about 100 yards inside the forest and 50 yards from the stream bed. The nest is clearly visible from the farm road, and I have had it under close observation for nearly 4 years. The nest is about 6 feet across and the same in depth, and is placed in a fork about two-thirds up the tree, against the trunk.

During a very heavy storm in 1963 half of the nest collapsed, but fortunately the young bird was just able to fly. On 17.xi.63, when the juvenile was over a year old, all three birds reassembled at the nest tree, and each in turn climbed all over the collapsed nest. The young bird was especially excited, and spent a long time on it, calling continuously, while the parents perched quietly nearby. At the end of June 1964, both adults arrived to repair the nest, and commenced their 2-year breeding cycle once more. I have deduced this cycle as follows: farm workers tell me that the birds bred in 1956, and 1958, while I have observed them breeding in 1960, 1962 and 1964. The timetable is worth recording, if only to confirm work by L. H. Brown. The adults begin displaying and paying attention to the nest about the end of June, the female starts to sit in mid-August, and there is no sign of eggs hatching until mid-October, when the Eagle stands up, or makes a stiff flight to a nearby tree. Even then the chick is not visible until a month later at least, but it grows fast thereafter, with the female feeding it daily and tearing its food up until February. Early in this month the feeding becomes less frequent, and the young bird starts its hunger call, a rapid plaintive whistle that it will keep up all day if necessary. It also starts to climb around the nest tree about now, and by the end of the month it may have made its first flight, although it continues to be fed at the nest; sometimes the nestling takes another month before it decides to fly. The young bird continues to use its hunger call irregularly for another 8 to 12 months within half a mile of the nest, and finally disappears when it is about 18 months old. Some can be quick at finding their own food, for my headman, Mr. Kamonde, who is a reliable observer, saw an immature bird in May, still in its white plumage, take a half-grown Colobus Monkey off the limb of a dead tree with scarcely a pause in its flight. The female appears to do all the building herself, as well as adding green branches during the time she is on the nest, but the male can generally be seen sitting quietly by. They make a devoted pair, and once during a torrential downpour, (and the rain is cold at this altitude), I watched the female brooding with outspread wings over the chick, while the male perched on a branch about ten feet away; during this time the two birds maintained a continuous soft piping to each other. The display of these Eagles takes place mainly during the 18 months between the start of nesting to the departure of the juvenile. As the birds breed in alternate years, there is a gap of about six months when they are seldom heard. The display is well described by L. H. Brown (Eagles p. 186) and usually takes place over the forest, not far from the nesting site; on occasions the bird will rise to a very great height, and carry on calling far out over the grasslands. Either one or two birds may be seen in the display flight, but I suspect only the male does the calling, a far carrying "ke—wik ke—wik ke —wik"; the female's call is different, described by Chapin as "pee-ou" rapidly repeated. I have generally heard this call from the nest, and it appears to be a call for its mate; standing on the nest beside its chick the bird flattens itself right out and opens its bill wide to get maximum sound, varying the speed and pitch of the notes; the call lasts about two minutes, and then the bird listens and looks around before starting up again, and so on for half an hour. There are about six or seven pairs in the district, all with territories bordering on the forest, and 3-4 miles betwen each pair; altogether they must be fairly numerous over the Mau.

LONG-CRESTED HAWK-EAGLE, *Lophoaetus occipitalis* (Daudin).

Uncommon visitor. This eagle is usually seen over the forest if at all, whereas at Njoro it is a bird of the open farmland. Six records for 1962, none in 1963.

BLACK-CHESTED HARRIER-EAGLE, *Circaetus pectoralis* Smith.

Regular visitor, which possibly breeds locally. Immature seen on farm in June and July 1961.. Generally singly, once or twice in pairs. They spend a lot of time hovering, but I

have yet to see one make a kill. Always seems to be in the air, rarely perches on a fencepost and never seen in a tree.

BATELEUR, *Terathopius ecaudatus* (Daudin).

Status as for preceding species; it appears about alternate months, and the farm must be on the edge of a territory. On 27.ii.62 an immature bird was chased by an adult in a wonderful aerial exhibition. Their relationship to Tawny Eagles is curious, as I have seen a pair chase the latter away with much gusto, but another time I watched a Tawny Eagle devour a large Mole-snake, while a Bateleur sat on the ground a few feet away, for over an hour, not daring to approach. Perhaps their mastery is confined to the air.

FISH EAGLE, *Cuncuma vocifer* (Daudin).

One record, 20.ii.55, a bird perched in a small cedar tree above a tiny pool, in the late evening.

STEPPE BUZZARD, *Buteo vulpinus* (Gloger).

Winter visitor. This is not an easy bird to distinguish from the Mountain Buzzard at a distance, and it is not possible to say if these birds reside for the winter, or are on passage only. They even appear to consort with the Mountain Buzzards, which confuses the situation. However, I have recorded it for all months from September to April.

MOUNTAIN BUZZARD. *Buteo oreophilus* Hartert.

Resident. One or two pairs, but I have not found their nests. They are seldom seen any distance away from the forest and are generally found circling over the trees or perched quiet on a bough; when disturbed, they slip silently off and move to another tree a little further on. Their "mew" is very like that of a European Buzzard's *B. buteo* (Linnaeus). They have a fast "switchback" disply flight, during which they mew loudly.

AUGUR BUZZARD, *Buteo rufofuscus* (Forster).

Common resident. About six pairs breed on the farm, mainly April/May and October/November. Highly beneficial, as one of their staple foods is the mole-rat, which causes immense damage to pasture and grain crops. About one in three is black-phased, and these seem to predominate in one particular family. They seem more active here than at lower altitudes, and are flying and hovering most of the day. They are very audacious in defence of their territory, and I have seen them chase off Tawny, Steppe, Crowned and Bateleur Eagles in a most aggressive manner. If a single bird starts the chase, it is only a matter of moments before the mate has arrived. Only once have I failed to see both birds, and that was when a female Crowned Hawk Eagle had been calling for half an hour, fed her young, and then joined in a simultaneous display with her mate. In the course of this flight, they came too close to the cedar tree where the Augur Buzzards were nesting. A small adult Buzzard came shooting out, which I took to be the male, and engaged with the female Eagle. The normally lethargic Buzzard put up a series of terrific power dives, and the Eagle had to turn over on her back each time, and I could see her claws lash out at her pursuer, ducking her head as he came shooting past. The Eagles then retired to a tree in the forest; I think the second Buzzard must have been sitting too tight to be able to leave her nest.

In spite of being so common, Augur Buzzards are, for a large bird, quite hard to recognise in the field, due to their innumerable colour phases; a young bird with no barring on wings or tail (which is much longer than an adult's,) dark brown above and below, took a long time to identify. They can often be seen flying back to their roosting tree after sunset, when they look very owl-like, and in the early morning they may be seen on their favourite look-out perch long before the sun is up.

LITTLE SPARROW-HAWK, *Accipiter minullus* (Daudin)

Occasionally seen.

RUFOUS SPARROW-HAWK, *Accipiter rufiventris* Smith.

This Sparrow-Hawk has been clearly identified on occasions, but this group is particularly hard to verify in the field, as usually all one sees is a flash of grey or brown, and the bird has disappeared into the thickest trees; the relative status of each species is hard to assess.

GREAT SPARROW-HAWK, *Accipiter melamoleucus* Smith.

Resident nearby. This bird is sometimes seen on the farm, but its real habitat is in the thick forest outside the farm boundary. An immature female was caught in the poultry-run on 10.iii.65. I have also seen a black-phased bird flying through the garden.

SHIKRA, *Accipiter badius* (Gmelin).

Occasional visitor, one bird staying near the house for two days in July 1962. For most of the time it remained in some young pine trees, making a purring "coooorr coooorr", perhaps akin to the sound made by the Ovampo Sparrow-Hawk, as described in Praed and Grant.

AFRICAN GOSHAWK, *Accipiter tachiro* (Daudin).

Occasionally seen, but may well be a resident. Generally one only catches a fleeting glimpse of it, but on 20.xi.62, I saw a single bird dive down to attack a Common Sandpiper which was running on the rocky edge of a stream. The wader evaded the attack by jumping into the little pool, whereupon the hawk squatted down on the rock alongside. I was able to observe the bird at close range with binoculars for some minutes, and had to disturb it eventually to see its appearance in flight.

DARK CHANTING-GOSHAWK, *Melierax metabates* Heuglin.

One record, January 1965, in the garden.

MONTAGU'S HARRIER, *Circus pygargus* (Linnaeus).

Regular winter passage migrant, but less common than the Pale Harrier. They are seen throughout the winter months, but not apparently staying on the farm. They arrive in early October, when they move fast and purposefully. Later they are generally seen leisurely quartering, and moving eastwards.

PALE HARRIER, *Circus macrourus* (Gmelin).

Common winter passage migrant, generally moving east at both seasons. Both these harriers are most often seen in pairs, the male bird 200 to 300 yards in front. If the predominant east wind is at all fierce, the birds will drop to the ground and rest for half an hour before drifting into the wind again. One female or immature that had apparently lost its mate, uttered a high "kitter kitter kitter" every minute or so; the only time I have heard these harriers make any sort of noise. The date of autumn arrival is the first week of October, once late September.

MARSH HARRIER, *Circus aeruginosus* (Linnaeus).

Regular passage migrant, and some years a winter visitor, when one or two birds will frequent the dam for weeks. The early birds are seen mid-October and then only a few until the return passage in March/April. The African race, *C.a. ranivorus* (Daud), has only been confirmed on one occasion, June 1963, and can only be an unusual visitor. The Marsh Harrier is seen in much smaller numbers than the preceding harriers, and seems a more sedentary bird. It will spend hours on a fence post ,or sitting on the ground or in reeds beside the dam. The earliest arrival was an adult male on 25.ix.65.

HARRIER-HAWK, *Polyboroides typus* Smith.

Uncommon visitor, mainly March and December. It is seen more regularly a few miles to the east; where I suspect it to breed, as I have seen an immature on this farm in March. Generally observed near forest, where it is often seen clinging with outstretched wings to the trunk and foliage of cedar trees looking for prey.

MONTANE REDWING FRANCOLIN, *Francolinus psilolaemus* Grey.

This bird is called *F. shelleyi theresae* Meinertzhagen in Praed and Grant, and was identified for me by Mr. John Williams (following the revision by Hall 1963) from a specimen I sent him. In voice, habits and appearance it resembles closely the Redwing, *F. levaillanti*, (Valenciennes), and Shelley's Francolin, *F. shelleyi* O. Grant. Normally found in pairs or with young, which stay with parents until next breeding season. The young chicks are seen from June to August, and there is some indication that this species breeds again in September. About five young are reared.

SCALY FRANCOLIN, *Francolinus squamatus* (Cassin).

Two or three pairs resident on farm. Breeding season May and June.

JACKSON'S FRANCOLIN, *Francolinus jacksoni* O. Grant.

Resident, with about six pairs on farm. A pair seems to keep to the same small area for years, and although breeding successfully their numbers do not increase. They breed at any time of the year, and stay in family coveys for about 8 months, after which time they are seen in pairs. They frequent the forest edge, moving out into the grass leys and 'shambas' in the morning and evening. They are very partial to beds of nettles, which is perhaps why serval cats are, as well ! I have seen up to seven chicks in a brood.

QUAIL, *Coturnix coturnix* (Linnaeus).

The European race has not yet been confirmed in hand, but probably occurs. The African race, *C.c. africana* Temminck & Schlegel, is a resident, and probably commoner than in the past due to increased cultivation. It is usually seen in pairs, and may breed regularly, but I have rarely seen young birds, usually September and October. Up to 50 pairs on the farm.

HARLEQUIN QUAIL, *Coturnix delegorguei* Delegorgue.

Irregular visitor, chiefly May, June and July. I have recorded this bird with chicks in June and July 1954. On two occasions in June there has been evidence of night migration, with birds hitting lighted windows in some numbers.

[CRESTED GUINEA-FOWL, *Guttera edouardi* (Hartlaub).]

I have not seen this bird on the farm, but include it as it has been taken nearby on Mr. Grainger's farm, and I have also seen it only a few miles away inside the forest. It is a most beautiful bird, with brilliant metallic blue plumage.

BLACK CRAKE, *Limnocorax flavirostra* (Swainson).

Only two brief glimpse so far on the dam, but it is now resident on larger and better-covered dams in the district. No records prior to 1964.

AFRICAN MOORHEN, *Gallinula chloropus meridionalis* (Brehm).

Two records of single birds on this farm, and it is an uncommon resident on local dams, breeding in November.

RED-KNOBBED COOT, *Fulica cristata* Gmelin.

Resident, breeds. One pair appear to have bred three times in less than 12 months, and reared a total of 10 chicks, nesting in September, February and July 1961/1962. As the young grew, they seemed to take on the function of tending the latest hatched, as immature birds were seen attending tiny chicks and feeding them, each bird to a separate chick; this is a habit normally employed by the adults. The numbers on the dam vary, and there are generally one or two pairs, which breed January and February, June and October. Bad-tempered, they do much to frighten away other water-fowl, and I have seen them chase Egyptian Geese.

SOUTH AFRICAN CROWNED CRANE, *Balearica regulorum* (Bennett)

Resident, breeds. Two pairs always reside on the farm, one by the dam, the other a mile away by a small weir. They nest regularly, but have difficulty in rearing young. The young stay with parents for 8-9 months, and the adults may then start to nest again immediately. Eggs have been laid in most months of the year. The immature birds appear to join a small flock a few miles away, on leaving their parents.

JACKSON'S BUSTARD, *Neotis denhami jacksoni* Bann.

Uncommon visitor to farm, but may be resident nearby in the Masai, where it is more open, and where I have seen it from time to time.

JACANA, *Actophilornis africanus* (Gmelin).

Two records only, April 1963 and June 1964, single birds that only stayed a day.

RINGED PLOVER, *Charadrius hiaticula* Linnaeus.

Uncommon winter passage migrant. One bird seen on 17.iv.66 was with a party of 6 Common Sandpipers.

THREE-BANDED PLOVER, *Charadrius tricollaris* Vieillot.

Passage migrant seen most years, generally November to January, and June to August, staying for a few days. Call is high and staccato, "peet peet", when alarmed, and a soft "pit-pit-pit" on alighting. At other times the single alarm call is run into a variation of a number of notes. Nearly always within a short distance of the dam, often in pairs.

CASPIAN PLOVER, *Charadrius asiaticus* Pallas.

Uncommon winter migrant, arriving August and September, and not seen much until return passage in April. Groups number 3 to 20, and are often in larger flocks of the Blackwinged Plover. Their alarm call note is a soft "tsik tsik". My dates of arrival are a lot earlier than given in Praed and Grant, and I have a good sight record for a pair on the 28th and 29th August 1962.

CROWNED LAPWING, *Stephanibyx coronatus* (Boddaert).

Rare visitor: two birds stayed a few days in April 1965.

BLACK-WINGED PLOVER, *Stephanibyx melanopterus* (Cretzschmar).

Partial resident, which undergoes considerable local migrations. Thus, the first single birds appear in late January, and numbers increase slowly to March/April, when breeding commences if conditions are right, otherwise not until May/June. By June, the early juveniles flock with the non-breeders, and by July there are flocks of 100 or more over the district. In August/September these have grown into vast flocks of over 1,000, perhaps even to 10,000, and then they all suddenly disappear, although they can be heard passing over at night or in thick mist during this period. They have been seen down on the Narok plains, about 40 miles south of the farm and 3,000 ft. lower, and this may be the ground to which they move.

The bulk of the breeding takes place in May/June, 2-4 eggs being laid in what can only be described as a scrape, although bits of straw and sheep droppings are added sometimes. The eggs are often laid on newly turned earth, the action of a tractor cultivating the soil causing a remarkable stimulation of egg-laying. As the tractor passes, the hen birds squat down in broody postures all around, and by the time the tractor returns the first egg has been laid, and the bird sits in a threatening attitude until the tractor is within inches of its bill. I have observed this sequence of actions on several occasions, but the occurrence must depend on many synchronising factors. It is hard to say what happened before the arrival of tractors, but perhaps the ploughed land has attracted a concentration of breeding birds. The liking for bare earth could perhaps be due to the increase of soil temperature from cultivations, or to the improved camouflage against the darker earth. As the birds fly in they make a vivid pattern of black and white, but the moment they close their wings they become nearly invisible, so perfectly do their colours blend with the soil; the eggs too are very hard to see on the bare ground even when the nest is marked.

AVOCET, *Recurvirostra avosetta* Linnaeus.

One record of a small party on dam in 1954, Mr. & Mrs. Grainger saw a single bird in a puddle on their farm road, about three miles from here, 27.iv.65.

BLACK-WINGED STILT, *Himantopus himantopus* (Linnaeus).

Occasional visitor, staying several days at a time, in two's and three's. Records from late September to March, suggesting birds are northern migrants.

GREAT SNIPE, *Capella media* (Latham).

Four records, for December, February and March; single birds only.

AFRICAN SNIPE, *Capella nigripennis* (Bonaparte).

Resident, although numbers fluctuate according to weather. In the dry season only one or two birds may be found in isolated damp spots, but after prolonged rain, there may be fifty pairs on the farm. I have found newly hatched chicks, but the only date for them is October 1964, and I have been unable to find a nest. If breeding coincides with display, it would appear that the Snipe breeds at any time of the year when conditions are suitable, although this would tend to occur mainly in July/August. Display consists of two types; one in which the bird stands on a low mound or a fence post, and utters a rapid, piping "pic-pic-pic-pic" for about a 5-second burst, and continues for a quarter of an hour or more. The other is the drumming which resembles that of the European species *C. gallinago*

(Linnaeus), but is not identical. The African species makes a circular flight, climbing rapidly to about 50 ft., then diving almost to the ground with a few quick wing beats, and making the drumming sound with its tail. The drumming bird has been seen to do this in circles round a standing piping bird, and I thought they might be male and female, but I have seen one bird make both sounds, so it might have been coincidental. The "scape" alarm call is also used as an antagonistic note during chase, repeated several times.

CURLEW SANDPIPER, *Calidris testacea* (Pallas).

Two records on dam; single birds on 7.xi.60 and 14.iii.61.

LITTLE STINT, *Calidris minuta* (Leisler).

Regular winter visitor and passage migrant, some birds staying on dam for several months, others passing straight on. Usually 3 to 10 birds. Early date 15th August, late date 19th April, when birds were in breeding dress.

TEMMINCK'S STINT, *Calidris temminckii* (Leisler).

One record, a single bird with 7 Caspian Plovers in a waterlogged wheatfield. 7.x.62.

RUFF, *Philomachus pugnax* (Linnaeus).

Irregular winter passage migrant. Most of the ones I have seen here have had orange legs. Latest date, 19th April.

COMMON SANDPIPER, *Tringa hypoleucos* Linnaeus.

Winter visitor and passage migrant. Those that stay appear to prefer the rocky streams, where they may be found for 2 or 3 months, while those passing through are generally seen on the dam. An early arrival was noted on 11th July, and another on 15th August. Although these might have been resident Kenya birds, they seemed from their exhausted state to be migrants. These birds are probably on their way much further south, as their stay is very brief. The winter visitors that come to stay arrive about October. Late date, 21st April, bird in fat condition and breeding plumage.

GREEN SANDPIPER, *Tringa ocrophus* Linnaeus.

Winter visitor, in varying numbers, but usually 3 or 4 single or paired birds on farm, Prefers wet grassy streams, but also seen on dam. On 17.iii. 63, a pair was seen resting on the dam spillway, in bright plumage, and the male called a continual "tweeeeeee twi twi twi twi", until alarmed, when they flew off with their usual call. From Witherby's remarks this would appear to be their song. Earliest arrival 29th August; late date, 20th April.

WOOD SANDPIPER, *Tringa glareola* Linnaeus.

The commonest of the winter visitor Sandpipers, and seen in one's and two's, although sometimes passage migrants appear in small parties. Eight birds were seen in late December, passing through, and on 27.iv.62 at 2.30 p.m., I saw 20 resting birds on the dam weed, which had gone again in two hours. Latest date, 5.v.61.

MARSH SANDPIPER, *Tringa stagnatilis* (Bechstein).

Uncommon winter passage migrant, with three records, a pair and two singles, for October, November and December.

GREENSHANK, *Tringa nebularia* (Gunnerus).

Uncommon winter passage migrant, usually in pairs, once a party of six. Generally October to December; late date 16.iv.64.

TEMMINCK'S COURSER, *Cursorius temminckii* Swainson.

Occasional passage migrant, singly or in small numbers.

GREY-HEADED GULL, *Larus cirrocephalus* Vieillot.

Occasional visitor, staying for a few days on the dam, from one to four birds at a time.

WHITE-WINGED BLACK TERN, *Chlidonias leucoptera* (Temminck).

One bird on dam, 4.i.64. Another bird was seen by Mrs. Lutyens on her dam in November 1965.

OLIVE PIGEON, *Columba arquatrix* Temminck & Knip.

Local migrant, undergoing large movements of vast flocks; some years the pigeon is resident all 12 months, other years it occurs only sporadically. Breeding may take place either rarely, or on and off through the year, chiefly November/December. The display flight consists of a few slow wingbeats taking the bird about 20 ft. above the tree tops, and then a stiff-winged glide to another tree about 50 yards away, during which it utters a loud mewing sound; perhaps described as a nasal "twaa twaa". This is best heard on a damp misty evening, when the birds sound as loud as a flock of bleating goats. The song is a deep musical "booboobooboo".

PINK-BREASTED DOVE, *Streptopelia lugens* (Rüppell).

Very common resident, which may breed throughout the year. It congregates at certain times into large flocks of 100 to 200, sometimes many more, causing damage to newly planted wheat, when they pick up the grain. They roost in the forest, but flight off to feeding grounds in the early morning. They are always moving about, usually in small parties, probably due to their need for water.

RED-EYED DOVE, *Streptopelia semitorquata* (Rüppell).

Only three records.

RING-NECKED DOVE, *Streptopelia capicola* (Sundevall).

Unrecorded for 7 years, but now appears to have spread west from Rift Valley escarpment, and is resident in small numbers, mainly near tree plantations. Nesting April, 1962, juvenile, June 1961.

LAUGHING DOVE, *Stigmatopelia senegalensis* (Linnaeus).

One record, a very wild bird on edge of Masai grassland, 14.viii.62.

NAMAQUA DOVE, *Oena capensis* (Linnaeus).

One bird stayed for about a week in March, 1965, usually being seen on a dusty road; another was seen a few miles away by Mrs. T. Hamilton-Fletcher, also on a farm road. No other records.

CUCKOO, *Cuculus canorus* Linnaeus.

Both subspecies, the European (*C.c. canorus*) and African (*C.c. gularis* Stephens), are rare passage migrants through the farm. One bird seen in forest on 27.x.62, was the hepatic variation of the European race, having a bright chestnut plumage, barred blackish, with no white markings, and corresponding exactly with the description in Witherby. A bird of the African race was seen to eat a large and very hairy caterpillar, 11.xi.63.

GREAT SPOTTED CUCKOO, *Clamator glandarius* (Linnaeus).

One record, 21.xii.65.

BLACK-AND-WHITE CUCKOO, *Clamator jacobinus* (Boddaert).

Uncommon passage migrant, being seen once by me, in November 1964, and twice by Mrs. Lutyens, in July and September 1965.

HARTLAUB'S TURACO, *Tauraco hartlaubi* (Fischer & Reichenow).

Common resident in the forest, although some years it becomes scarce from July to October. I have not yet found a nest or other signs of breeding. I would expect them to breed at the turn of the year, as from May onwards they are seen in small flocks of up to 20 birds. Unlike many other forest birds, which follow the riverbeds away from the true forest, I have not yet seen this bird in the open at all, as suggested in Praed and Grant.

RED-HEADED PARROT, *Poicephalus gulielmi* (Jardine).

A resident of fluctuating numbers, which like the last species is sometimes absent during the middle months of the year. Again, I have found no signs of their breeding, and there is no description of their nest in Praed and Grant. Often they are to be seen in the early morning setting off for their feeding grounds, accompanied by loud whistles and screeches, in bands of a dozen or two, often with large numbers of Olive Pigeons.

EUROPEAN ROLLER, *Coracias garrulus* Linnaeus.

Rare winter passage migrant, as I have only three definite records for April 1964 and 1965 and November 1965. However they are more often seen singly, on farms to the east, and their route seems to lie nearer the floor of the Rift Valley.

LILAC-BREASTED ROLLER, *Coracias caudata* Linnaeus.

Two records only, for September 1961 and October 1962.

RUFOUS-CROWNED ROLLER, *Coracias naevia* Daudin.

One record, December 1962.

[MALACHITE KINGFISHER, *Corythornis cristata* (Pallas).]

A small Kingfisher with red underparts has been seen three times on this farm on the small streams by different people, and I myself have seen this bird on a small dam on another farm nearby. As I have seen this species at Narok, this is likely to be the one that occurs here.

BEE-EATER, *Merops apiaster* Linnaeus.

Regular passage migrant, mainly on the spring movement. Generally it passes south in late September to mid-October, and returns mid-March to end of April, late dates 8th May 1964, 9th May 1965. Parties of about 20 birds are most usual.

WHITE-THROATED BEE-EATER, *Aerops albicollis* (Vieillot).

One record for July 1964, a party of six birds seen resting and occasionally feeding by the dam. A large group of mixed African swifts, swallows and martins were around and the bee-eaters may have been in loose company with them. Their flight call is similar to that of *M. apiaster,* and they may be over-looked when passing overhead.

CINNAMON-CHESTED BEE-EATER, *Melittophagus oreobates* Sharpe.

Local migrant, which visits the farm for about six months during which it breeds. It arrives about October, breeds in December/January, and leaves in April. The call is a sharp, high-pitched, metallic "cleek", and is often the first hint of the birds' presence. The song is a little tinkle of about a dozen notes of a variation of this call-note, and is not often heard.

CROWNED HORNBILL, *Tockus alboterminatus* (Büttikorfer).

Local resident, not always present on farm, but display and song observed, so must breed nearby. They are especially fond of the berberis fruit, which takes them out over the grassland some distance from the forest. When they come to the garden their main quarry seem to be chameleons, which they are very adept at finding. Normally seen in parties of 4-6 birds along the forest edge or up the wooded valleys.

GROUND HORNBILL, *Bucorvus leadbeateri* (Vigors).

Resident, sometimes absent for short periods. A very young bird, seen with adults in October, had the bare skin around the head a dull straw colour, and the plumage itself was duller black than that of the adults. The feathers were very rough and quite lax, and the bird appeared to have left the nest recently, as it showed no fear of me at all. The female which had no casque, had the bare skin red, not blue as in Praed and Grant, and was very courageous in staying by the young bird, while the male ran on ahead, blowing out its wattles. Another female I observed had the bare skin round the face entirely blue; this bird was perched on a post near the borehole pump which was making a dull clanking noise, and in time to this mechanical noise, the Hornbill was making a low booming sound in reply. It kept this up even when I approached to within a few feet and its wings were out-stretched ready to fly. When it flew off it alighted on the edge of the forest, when it started booming again. As it boomed it blew its blue wattles right up, sucking them in again after each series of notes. This description compares with Praed and Grant's note that the female may make an answering call on a lower tone; possibly the bird mistook the deep clank of the well-head for the sound of a male hornbill ?

GREEN WOOD-HOOPOE, *Phoeniculus purpureus* (Miller).

Passage migrant, single birds on 6.x.62 and 10.xi.63.

WHITE-HEADED WOOD-HOOPOE, *Phoeniculus bollei* (Hartlaub).

The common resident Wood-hoopoe of the cedar forest. In parties of about a dozen birds, their presence proclaimed by their loud chattering cries; these are on two notes, one harsh, the other a more whistling one; they also make a soft piping "chi chi, peepeepeepee". Young, with streaky crown, seen in February.

BARN OWL, *Tyto alba* (Scopoli).

One record, 22.i.64.

AFRICAN MARSH-OWL, *Asio capensis* (Smith).

One record for 1.iv.66.

MACKINDER'S OWL, *Bubo capensis mackinderi* Sharpe.

Resident, at least 4 pairs nesting within two miles of the house. They are partial to the lightly timbered valleys with a small stream running down, and they make their nests on the bare earth under some light bush or overhanging rock, above the water. Normally they roost in the cedar trees by day, not necessarily against the trunk; but where the trees are absent they become ground roosters, taking cover in heather or bunch grass. Mr. Stephenson, on the next farm, found a pair of these birds nesting on a grassy slope some 30 ft. above a 3 acre dam. Three eggs, measuring 58 × 45, 58 × 46 and 59 × 46 mm, were laid before 26.ii.64, and hatched about 18.iii.64. This pair had another clutch, found on 29.xii.64, and these eggs measured 59.5 × 45, 58 × 45 and 56 × 45 mm. The chicks were hatched with white down, and by a month old had acquired a greyish-brown, rather sooty plumage, with dark brown barring from nape to tail. The eye was a chrome yellow with bright blue pupil; feet and bill dark horn. At a later stage they show a conspicuously pale face marking, surrounding the gape. It was difficult to tell the sexes of the adults apart and to say if the male took part in incubation, but he was found quite near the nest in daytime. The three chicks were wantonly destroyed at two months old, as were some others Mr. Stephenson found in another nest, probably by Africans for superstitious reasons. Large nestlings have been found, in November (three times) and in January, small ones in December and March, young birds seen flying in January, April and May. Working back from these dates, egg-laying would appear to take place from August to February. The same nest is used many times, and then may be moved only a few yards. From casts and from litter in abandoned nests, it appears that food consists mainly of mole-rats; twice I have found crab shells. They have a deep hoot, usually with a long and short note: "hooooo...hu"; in addition they make a barking "wak wak", and this may be heard with the hooting, but it is also an alarm call, as I have seen a bird make it as it watched my dogs running below its tree-roost. An immature bird made a harsh, staccato squawk when mobbed by shrikes. The bird is well distributed, as nearly every valley has its pair, and local Masai tribesmen, who know it well, confirm this.

VERREAUX'S EAGLE-OWL, *Bubo lacteus* (Temminck).

Rare visitor, April 1964 and March/April 1965, when it grunted through the night outside the house.

NIGHTJAR, *Caprimulgus europaeus* Linnaeus.

Two records identified from male specimens picked up from the road, 29.iii.61 and 2.iv.65. Birds not identified in the hand but appearing to be this species are often seen in the winter months, and it may be that it is a common winter visitor.

ABYSSINIAN NIGHTJAR, *Caprimulgus poliocephalus* Rüppell.

Common resident, and partial migrant.

SPECKLED MOUSEBIRD, *Colius striatus* Gmelin.

Common resident along the forest edge; sometimes forms flocks of up to 100.

NARINA'S TROGON, *Apaloderma narina* (Stephens).

Observed twice in March 1961; not since.

MOUSTACHED GREEN TINKER-BIRD, *Viridibucco leucomystax* (Sharpe).

Generally common and vocal from October to April: then it becomes silent. I have seen it once or twice in July and August, but in spite of it being a difficult bird to see, I suspect that numbers move away from May to September. The song is very loud for such

a small bird, a very fast "pip-pip-pip-pip", accented on the last syllable. This is repeated with scarcely a pause over and over again. The note changes at times to become either higher or lower, but the phrase is always constant. I have only seen these birds feed on small berries.

GOLDEN-RUMPED TINKER-BIRD, *Pogoniulus bilineatus* (Sundevall).

Less common than the Green Tinker-Bird, with a shorter song-period, from October to December, once in February. The song is the well known "quok quok quok quok quok", at about a fifth of the speed of the last species, and nothing like so shrill. I have seen them in May and August, silent, so it may be that some birds remain the year round. They are also capable of making a loud hissing sound, just like a snake's, although I do not know for what reason.

BLACK-THROATED HONEY-GUIDE, *Indicator indicator* (Sparrman).

This bird is only known from its distinctive song, which is heard from January to March, and from one brief sight record. The song has only been heard from one small area on the edge of the farm, and it would appear that at the most there is only one pair, which may be migratory.

LESSER HONEY-GUIDE, *Indicator minor* Stephens.

Resident, possibly only one or two pairs. Inconspicuous outside song period, which extends from July to November. The song of one bird is delivered from the same branch high up in an olive tree year after year, and consists of "wheeoo, pleep pleep pleep", the "pleep" repeated 14 or 15 times at one second intervals, with a three minute pause; the cold drizzly weather which occurs at that time of the year does not seem to deter the bird from singing. I have seen this bird deliberately perch amid a swarm of wild bees, peering around intently as if to see where they were coming from. This Honey-Guide is usually found in the forest, but sometimes up the river valleys.

FINE-BANDED WOODPECKER, *Campethera taeniolaema* Reichenow & Neumann.

Resident, possibly the commonest of our three resident woodpeckers, although these species are often seen in company with one another. Young seen in August and December. Their call is a loud "che che che che", but they are rather silent birds. Twice I have watched two females feeding close together, which kept up a low buzzing note that sounded like "chwoor-ic wor-ic". This may be compared with J. H. Owen's description of a parent Great Spotted Woodpecker, *Dendrocopus major* Hartert, which he gives as a conversational "Too-ut". (Quoted from Witherby).

CARDINAL WOODPECKER, *Dendropicos fuscescens* (Vieillot).

Resident, and fairly common. Young seen in August and January. They have a number of calls, one of which is a deliberate "keekeekeekee" and another a strident rattle.

BEARDED WOODPECKER, *Thripias namaquus* (Lichtenstein).

Probably resident. It is rather less common than the other two Woodpeckers, and may have been overlooked. No breeding records. A fair amount of drumming is heard on the farm, but I have not yet managed to identify the bird performing.

GREY WOODPECKER, *Mesopicos goertae* (Müller).

Rare passage migrant, the only records being for November 1963 and March 1965, the birds crossing some open fields near the house.

RED-BREASTED WRYNECK, *Jynx ruficollis* Wagler.

Fairly common resident, and there may be twenty pairs on the farm, occurring mainly on the forest edge and up the lightly timbered valleys, but sometimes wandering across more open country where they can examine a line of fence posts for food. Their common song is either a harsh "chwoi chwoi chwoi" or a softer, piping "twee twee twee", uttered from a bare bough, the bill nearly closed, and the head thrust forward with each note. Before breeding commences in May, three or more birds will be found in a tree indulging in a lot of display, with much posturing, jumping about and excited calls. The red under-tail coverts are brought into prominence by the displaying bird perching over the head of another. The birds call a continuous "tuk tuk" and I have heard a wheezy chirrupping song at the same time. Witherby described the "tuk tuk" call as an alarm, in the article on the European Wryneck, *Jynx torquilla*, Linnaeus, but with the present species I have noted the alarm call

as a much more metallic "chip chip chip", the "tuk tuk" being used for display. The birds may be heard throughout the year and at any time of the day, though least from December to March. The dark line down the centre of the back is a good field character, and in flight, which is slightly dipping, the bird looks chunky, and rather larger than most small brown birds.

COMMON SWIFT, *Apus apus* (Linnaeus).

As Praed and Grant remark, the identification of Swifts in the field is extremely difficult, especially if one has had little experience. They are most noticeable when heavy storm clouds are about, as these bring them lower. I include the present species because large numbers of swifts pass through in April together with House Martins, flying rapidly East and obviously migrating.

[NYANZA SWIFT, *Apus niansae* (Reichenow.)]

Ordinary brown swifts are present throughout the year in fairly large numbers, and I consider that they may be this species. I have found no sign of nesting.

WHITE-RUMPED SWIFT, *Apus caffier* (Lichtenstein).

Three or four birds amongst a party of African Sand Martins, on 20.ii.62, answered closely to this species' description. I noted deep-forked tail, glossy blue-black underparts and small size.

HORUS SWIFT, *Apus horus* (Heugl).

Regularly seen in small numbers from the end of April to early July.

RED-CAPPED LARK, *Calandrella cinerea* (Gmelin).

Resident with some local movement. Breeds in April and May, flocking into some hundreds from July to October, after which more breeding may take place. A hen flying from a nest on April 24th had two eggs, 22mm X 15mm, which were heavily blotched earth brown on a coffee-coloured background. The male has a fine song which includes snatches of songs of other grassland birds, and it is uttered from the ground, from a fence post or in display flight up to 300 ft. above ground. They are aggressive birds, and are often seen chasing Black-winged Plover; their song includes good imitations of this bird, as well as several others such as Stonechat and Streaky Seed Eater.

AFRICAN PIED WAGTAIL, *Motacilla aguimp* Dumont.

Rare visitor until 1963, when a pair bred in June, and there are now two or three pairs breeding round the buildings. This is one of the birds that has been colonising slowly westwards with the spread of cultivation and habitation.

MOUNTAIN WAGTAIL, *Motacilla clara* Sharpe.

Regular visitor, but not common; it may breed further down the valleys in the forest. They are generally in pairs and sing frequently, both on the dams and near the rivers. At Molo and Elburgon I have seen their nests on the spillways of dams at 8,000 ft. and 9,000 ft; the latter on the 20.vi.64 had two chicks just hatched and one egg, 21mm × 14 mm, had small pinky-brown splashes over a buff background. The nest was a deep cup made of bunch-grass leaves woven into the tussock about 12″ above ground.

WELLS' WAGTAIL, *Motacilla capensis wellsi* O. Grant.

Only two records, September 1962 and December 1963. Both were for tame silent birds on the dam; these seemed rather exhausted, and I assumed them to be migrants.

GREY WAGTAIL, *Motacilla cinerea* Tunstall.

Uncommon winter passage migrant occurring singly. Early date September 25th. Occurs on fast flowing streams in or near the forest; one bird stayed for a week. I have seen this bird on the Aberdares at 10,000 ft., on a dam at Molo at 9,000 ft., and at Elmenteita at 6,000 ft., (in March) but nowhere does it appear common.

YELLOW WAGTAIL GROUP, *Budytes* general notes.

Three species, including a total of five races, occur as winter visitors; as they are not really identifiable on arrival, and their habits are very similar, it is proposed to treat them as a group before listing them individually. A few birds arrive early in September, and by the end of October small parties of up to 50 birds are scattered over the farm, mostly among

the flocks of sheep. When ploughing starts in earnest in March, they congregate in numbers round the tractors and are difficult to count, but run into many hundreds. They become very tame at this time, hardly moving out of the way of the implements; from the driver's seat, with binoculars, one can see every detail of their plumage, so that adult males of the various species can be recognised. *B. luteus* would appear to be the most common, followed by *B. flavus,* with *B. thunbergi* only occasional.

On the 21.x.62, I saw an interesting display by two birds out of a small flock of *Budytes.* I considered them to be immature *B. flavus,* both very pale ash-grey above, almost white below, except for the yellow under-tail coverts and brown pectoral band. The birds shuffled round each other in a dusty path among the sheep in a squatting fashion, with their mantle feathers raised on end, their tails right over their backs, and the yellow ventral feathers puffed out. Since the birds were immature, this observation, though of interest, may have no breeding significance; however, two further observations do indeed appear to indicate that occasional birds may breed locally, even though this has not yet, so far as I know, been recorded for Tropical Africa. The first observation was for a single *B. luteus singing* in November, and the second for a bird in *juvenile,* not immature, plumage in April. Witherby maintains that the moult from first winter plumage to adult takes place in January, so that this juvenile might well have been born in winter quarters.

BLUE-HEADED YELLOW WAGTAIL, *Budytes flavus* (Linnaeus).
Regular winter visitor, all birds appearing to correspond with the nominate race.

YELLOW WAGTAIL, *Budytes luteus* (Gmelin).
Very common winter visitor; an early date, probably for this species, was 8.ix.61, but the majority stay here between October and April. A bird I saw on 5.v.64 looked sick, and another I saw on 20.v.63 was very wild, and appeared a straggler. Jackson doubts the preference these birds have for following livestock, thinking it might be the type of ground they prefer, but there is no question that Yellow Wagtails like feeding in a flock of sheep, which doubtless disturb the insects for the birds to feed on. The Wagtails even perch on a sheep's back. Both races of *B. luteus* occur, as a few birds in March may be seen with the whole head a clear yellow, and these must be old males of *B. t. luteus.*

DARK-HEADED YELLOW WAGTAIL, *Budytes thunbergi* (Billberg).
Not a common winter visitor, and not usually identified until March or April. One bird I saw on 26.ii.63 was in brilliant spring plumage, and had the chin and throat pure white extending back to the neck, while another bird had a yellow chin. It would thus seem that both races, *B. t. thunbergi* and *B. t. cinereocapillus* occur. I have only seen this species on ploughland.

RICHARDS PIPIT, *Anthus novaeseelandiae* Gmelin.
Common resident, identified from specimens sent to Mr. J. G. Williams. Breeds January and June, probably other months as well. The bird is found on cultivated as well as indigenous grassland. Other species of pipits sometimes occur, but not yet identified in the field; a large pale bird I have seen occasionally may be the Sandy Plain-backed Pipit, *Anthus vaalensis* Shelley.

TREE PIPIT, *Anthus trivialis* (Linnaeus).
Winter visitor, but not in large numbers. Their arrival dates are regular, but later than most migrants, viz. 7.xi.60, 7.xii.61, 26.xi.62, 3.xii.63, and 29.x.64. They leave about the end of March. Very tame indeed, one pair spending two winters around the kitchen door, although generally they are to be found near the forest edge, flying up into low branches when alarmed. It sometimes takes short soaring flights and its "cheez cheez" call may then be heard.

RED-THROATED PIPIT, *Anthus cervinus* (Pallas).
Winter visitor, fairly common but rather wild; partial to damp and marshy places. Arrives October/November and leaves end of March. Found singly or in small flocks, with one or two birds usually showing reddish cheeks; but the surest guide to identification is their call note, a very high thin "teep" or "tseep", reminiscent of a Redwing, *Turdus musicus* Linnaeus.

SHARPE'S LONG-CLAW, *Marconyx sharpei* Jackson.

Common resident, which breeds April to August. Fairly tame and seldom flies far. The song, usually uttered in flight as it circles about 30 ft. up, and heard throughout the year, is a thin, plaintive "tip tee teu" or "tip tip teee" this is expanded a little during the breeding season. The bird is found only in pairs or with young, on the open grassland. A nest found under a small tussock on 18.i.66 contained two newly-hatched young, and one egg measuring 24 × 17 mm; the egg was splashed all over with light brown.

ABYSSINIAN HILL-BABBLER, *Pseudoalcippe abyssinicus* (Rüppell).

Fairly common resident throughout forest; sings all the year, but most strongly in April and May and again in November and December. Normally in pairs, sometimes seen in little flocks. The call note is a low chuckle "kwa kukukukkluk", or else a soft "quup quup" similar to the Greenbul's. The song as remarked in Praed and Grant, is very fine though rather short; occasionally I have heard a longer burst. The pure flute-like quality of the tone is the outstanding feature; for this, the bird can have few rivals.

DARK-CAPPED BULBUL, *Pycnonotus tricolor* (Hartlaub).

Very common resident which congregates after breeding in June and July, often in company with numbers of Olive Thrushes.

OLIVE-BREASTED MOUNTAIN-GREENBUL, *Arizelocichla tephrolaema* (Gray).

Well distributed but not very common throughout the forest. It is a silent bird, so may well be overlooked a certain amount. The only sounds I have heard are a low "quup quup", a scolding "schurr" and a thrush-like cackling; and once I noted a low bulbul type of song which was unremarkable. These birds are often associated with Hill-Babblers and are found frequently feeding within feet of each other. I have no record of their breeding except for a family party including young birds in April 1964.

SPOTTED FLYCATCHER, *Muscicapa striata* (Pallas).

Only one record, for 15.iv.63, the bird unexpectedly using large clods of earth on the edge of a ploughed field as a perch from which to catch insects. It was a greyish bird, which might imply that it belongs to the Asiatic race, *M.s. neumanni* Poche.

DUSKY FLYCATCHER, *Alseonax adustus* (Boie).

Common resident throughout forest and along forest edge, as well as in the garden. It breeds from December to February and from May to August, and the fledglings are very conspicuous when they are being fed by their parents. They are usually in pairs or in family parties, but sometimes before breeding one may see a number of them chasing each other around among the treetops with a lot of excited twittering. The call note is a very high squeak "tit" or "tsit", and the song is an expanded variation of this, rather stuttering. They are tame little birds, and when they turn in the air back to their perch after catching an insect, their wings give an audible snap.

WHITE-EYED SLATY FLYCATCHER, *Dioptrornis fischeri* Reichenow.

Common resident in garden and forest edge. Breeds from May to July, once in March. Song heard only rarely, and seemed as high as a bat's squeak, unlikely to be heard except at very close quarters.

MOUNTAIN YELLOW FLYCATCHER, *Chloropeta similis* Richmond.

Common resident in forest. Fine songster through the year. The alarm note is a sharp "chak chak" similar to that of the Blackcap or Brown Woodland-Warbler. Generally in pairs. No breeding dates, but a display was seen 5.x.62, when a bird was seen singing, raising its crest, swinging its head from side to side, and moving the tail and body in opposite directions. The mouth was opened wide and displayed to the second bird, the colour being a vivid red.

BLACK-THROATED WATTLE-EYE, *Platysteira peltata* Sundevall.

One record, a female, on 30.ix.63, on the forest edge. The white on the chin appeared as only a spot.

WHITE-TAILED CRESTED FLYCATCHER, *Trochocercus albonotatus* Sharpe.

Resident through the forest, generally where it is damper, and almost always in small parties of 5-6. A very active bird that flicks its wings and fans its tail without ceasing, and

continually utters its call note, a sharp "ti-ek". The song is heard less often, mainly in June and July, and it is rather a disjointed and staccato effort, but with many fine notes; I have heard it mimic the Brown Woodland Warbler accurately.

PARADISE FLYCATCHER, *Tchitrea viridis* (Müller).

Uncommon visitor or migrant, from July to November. The black and white variety has been seen once, deep in the forest.

OLIVE THRUSH, *Turdus olivaceus* (Linnaeus).

Very common throughout farm except where there is no cover at all. In the garden it becomes very tame and rather a pest, due to its fondness for fruit. It breeds from March to June and again in November. The song is a wild strident call of three or four notes "chow chee cher, chow chee cher chee", which does not seem to tally with Praed and Grant's description of a "low, sweet song". The song period is short compared with that of other song birds. Flocks of up to 30 birds occur in July and August, sometimes with numbers of Bulbuls, when they fly high through the forest amongst the cedars, feeding silently in the topmost branches of the trees.

ABYSSINIAN GROUND-THRUSH, *Goekichla piaggiae kilimensis* Neum.

Uncommon bird of the densest and dampest parts of the forest, where it may be resident. I found an adult with a juvenile in June 1961, the young bird making a very high pitched "seeep" the whole time; it was tawny above, with black spots on a brown background underneath. I have recorded the song in April and August, and seen birds apparently taking food to the nest in April and May, so the breeding season seems to be during the middle of the year. The song is loud and thrush-like, and well-described by van Someren in Praed and Grant for the nominate race, but it is a shy singer and not often heard. The race was identified for me by Mr. J. G. Williams from a specimen.

WHEATEAR, *Oenanthe oenanthe* (Linnaeus).

Winter passage migrant, the first birds passing through late September or October. It is not common, and nearly always seen singly. Only an occasional bird is seen after October until the return migration in February, when the birds are seen in breeding dress. None have been seen after the middle of March.

PIED WHEATEAR, *Oenanthe leucomela* (Pallas).

Rare winter migrant, two records for early March, one in December, the March ones in company with *Oe. oenanthe.* In flight the tail appears entirely white, and at rest almost black.

CAPPED WHEATEAR, *Oenanthe pileata* (Gmelin).

Resident, and perhaps a partial migrant, breeding in April/May, exceptionally in January. Originally this wheatear was common throughout the district, but for some reason the increase in cultivation has caused a diminution of numbers; probably the rat holes they use for nesting have been ploughed out. Outside the farm boundary on the Masai grasslands the bird is still common. Its short song period is restricted to the start of the breeding season, but it has a very fine, sustained song at this time. The song consists of a series of loud pipes mingled with grating sounds, and a number of mimicked phrases interspersed. The mimicry includes calls of Quail, Blackwinged Plover, Glossy Starlings and Red-Capped Lark, but the ability varies with individuals.

ANTEATER CHAT, *Myrmecocichla aethiops* Cabanis.

Common resident in the open country in the vicinity of earth banks. Breeds April/May. During display, up to 15 may be seen together, grouped on a row of fenceposts, the males(?) keeping up a continuous piping, with outstretched wings and up-pointed bills. They display indiscriminately, with four or five birds sometimes on a single post.

STONECHAT, *Saxicola torquata* (Linnaeus).

Common resident from forest edge to open grassland. Breeds March to June, usually 3 to 4 eggs in a nest placed in the shelter of a tuft of grass or heather.

ROBIN-CHAT, *Cossypha caffra* (Linnaeus).

Common resident where there is any cover, breeding from April to August. A tame bird in the garden, and a fine songster. Although they usually lay three eggs, they seem only to be able to raise one or two young at a time.

WHITE-STARRED BUSH-ROBIN, *Pogonocichla stellata* (Vieillot).

Fairly common forest resident. The song is a series of soft piping notes followed by a bubbling warble, and sometimes a croaking rattle. Young have been seen being fed in March, July and September to November. A field character that is quoted in all reference books is the white spot at the base of the throat; I have observed more than 30 birds at very close range, some of them in display when their eyespots appear raised and enlarged, and I have been unable to discern any sign of the spot on the throat. This spot is also shown prominently in the illustrations in these works, including Chapin's, but Chapin states he never saw this spot after watching more than a dozen birds. Priest (Vol. III p. 196) made the same comment, but attributed the characteristics to immaturity. It certainly appears to be common to all races of the species.

[GARDEN WARBLER, *Sylvia borin* (Boddaert).]

I have three records for a typical *Slyvia*, two in April and one in November, which might be for this species. The birds appeared very pale ash brown above, and whitish below.

BLACKCAP, *Sylvia atricapilla* (Linnaeus).

Common winter visitor, arriving mid-November onwards. The subsong is heard in December, and by February they are singing loudly through the forest. Some years they collect into large flocks before leaving at the end of March, and the volume of noise they make in chorus is remarkable. In 1961 I reckoned there were a 1,000 birds congregated along a mile of forest edge. In December 1963, on a cloudy, windy night, a number of birds flew into the lighted window-panes of a neighbour's house. I have only seen them feeding on berries.

SEDGE WARBLER, *Acrocephalus schoenobaenus* (Linnaeus).

One record for 16.iv.66, when I saw a bird feeding off floating weed on a stream, and in the rushes growing nearby.

CINNAMON BRACKEN-WARBLER, *Sathrocercus cinnamomeus* (Rüppell).

Common resident through forest and forest edge. A skulking bird that keeps to the cover of low bush. The song is as described in Praed and Grant, and may be recognised by the initial aspirate note. The call is a loud "seerk". They also make a soft "prrrrip" when they have young, and this is usually the only indication of breeding.

WILLOW WARBLER, *Phylloscopus trochilus* (Linnaeus).

Winter migrant, mostly seen in April, the latest date being the 28th. One arrival record for 28.ix.60, and the remainder single birds through the winter. One bird flew into the window at 9.00 p.m., on 12.xii.63, which indicates that they move about at night in the non-breeding season like the Blackcap.

CHIFF-CHAFF, *Phylloscopus collybita* (Vieillot).

A single bird stayed in the garden close to the house from the beginning of February 1966 to the 19th of that month. The bird sang daily from low shrubs, from the tops of pine-trees and especially from a spindly *Acacia baileyana*. The song was always vigorous, and I sometimes heard the soft warble which may be given at the end. The call note "hweet" I also heard several times. The only bird I saw was very tame, and from a few feet away I could easily distinguish the blackish legs and buff eye-stripe. I heard a Chiff-Chaff's song at the end of January 1964 in the garden, but the bird did not stay long enough for confirmation.

I made a tape-recording of this bird's song, and Mr. M. E. W. North was kind enough to confirm the identification from this tape. Mr. North suggested this was probably the first time the Chiff-Chaff has been recorded singing in Kenya.

WOOD-WARBLER, *Phylloscopus sibilatrix* (Bechstein).

One record for 3.x.62. I distinguished this bird from the Willow-Warbler by its pale green upper-parts, yellow breast and white belly; altogether a larger and brighter bird.

BROWN WOODLAND-WARBLER, *Seicercus umbrovirens* (Rüppell).

Common resident in the forest. In habits and appearance very like a Leaf-Warbler; its song is also similar, but it has a wider and more varied range of notes that make it superior

to that of any phylloscopine warbler that I have heard. The call is a distinctive 3-note "weer tee wew", and the alarm is a sharp "tchuk".

GREY APALIS, *Apalis cinerea* (Sharpe).

Common resident of the forest and forest edge. It is a conspicuous bird by reason of its loud song and variety of calls heard throughout the year, and is invariably found in mixed bird parties. The notes are adequately described in Praed and Grant. Birds in juvenile plumage have been noted in family parties in February, April and October. Display includes a deal of fanning of the tail to show off the white outer feathers.

CHESTNUT-THROATED APALIS, *Apalis porphyrolaema* Reichenow & Neumann.

Common resident of the forest. Distribution as for the previous species, with which it is often in company. It also has a distinctive song which betrays its presence throughout the year, which I describe as "pip-preeeeeeee pip-preeeee". They are also remarkable for the variety of call notes they make, mostly being churrings and rattlings similar to those of the European tit family (Paridae) I have seen young in February and July; as with the Grey Apalis, they appear to remain in family parties for a month or so after nesting, and then disperse to join mixed bird groups. Once the song is known, one realises how common they are, about equal in numbers to the Grey Apalis. The young have pale yellow chin and throat, (where the chestnut in the adult would be,) dull white underparts, and pale flesh legs which become almost red in the adult.

WING-SNAPPING CISTICOLA, *Cisticola ayresii mauensis* van Someren.

Fairly common resident on the open land. I can include the sub-specific name, since this was identified by Mr. J. G. Williams from a bird which Mr. North collected on 23.xi.64 from a nest. This nest, which contained three eggs, is worth describing, as Lynes was unable to do so, and Praed and Grant appear to have taken Lynes' notes on *C.a. ayresii.* The nest was in a tuft of green grass, and made from thistledown, lined with a "down" of a small silvery weed. The eggs measured 17 × 12.5 mm and were blue with a circlet of red-brown spots and scratches at the large end, and a few scratches towards the narrow end. The song, which is uttered between bouts of wing-snapping, consists of a thin piping of four notes: "der der dee du". Lynes mentions that there is no song during ascent, but I have definitely heard the bird sing as it rises into the air. This cisticola has adapted itself well to the advent of cultivation, and it may often be seen rising from a field of tall wheat or from short, dry stubble.

HUNTER'S CISTICOLA, *Cisticola hunteri* Shelley.

Very common resident of forest edge, garden and light bush. Breeding recorded for March, May and October, and may well breed the year round. Two nests were found by Mr. Daniell in his garden in 1962, placed in some small annual flowers and quite close together. One nest had been deserted with two eggs in it, and the other had five eggs, which were duly hatched. It would seem that one female had laid seven eggs. This Cisticola seems to be subject to some albinism, as I have now found three birds affected. One bird near the house had only the flight feathers and tail white; another bird a mile away was white with a few brown markings on its back and wings, which disappeared with successive moults, until it became completely white, and the third about 8 miles away, was pure white, but I saw it only once. The value of such albinos it, of course, that they are individually recognisable and can thus give an idea of their length of life and of their range of movement. Neither of the two birds I observed for a total of two years were ever seen more than 30 yards away from a central point, generally much nearer. One was seen for about 10 months, and the other for nearly two years, and in spite of being pure white, it seemed to be able to accomplish its duets, when it sang with and actually touched a normal brown bird.

STOUT CISTICOLA, *Cisticola robusta aberdare* Lynes.

A common resident, chiefly restricted to the wet grassland and open valleys. There is some overlapping with *C. hunteri.* I have added the sub-specific name after a specimen was identified at the National Museum. The song is a rattle followed by a few emphatic notes, "trititititit trit trit trit". The call is a nasal "chwer chwer chwer". The young are distinctive by being bright ochreous yellow below, shading to white on the belly. Breeds in February and May.

BANDED PRINIA, *Prinia bairdii* (Cassin).

An uncommon forest bird that is probably resident. It is partial to nettles and similar low vegetation in shady forest, and generally keeps well hidden. I have only once heard

anything like a song, an undistinguished warble, but they have a number of calls some of which may be used as a song, as I have heard them duetting: one bird made a loud "pwee pwee", the the other simultaneously making "keow keow", and when they ceased each time, both birds resumed their "chip chip" call, ("pink pink" in Chapin) which is their most usual call when feeding. This prinia is usually found in pairs, and family (?) parties of 5-6 have only been seen in May, November and December, which may indicate when they breed.

SWALLOW, *Hirundo rustica* Linnaeus.

Common winter passage migrant. They are always seen flying east and south, and at the height of migration, pass in groups of half a dozen every few minutes. I have rarely seen them perch or pause to feed, and they seem intent only on reaching the Rift Valley floor. They are seen throughout the winter months, but large numbers only occur in October, February and March. Late date 1.v.64.

ANGOLA SWALLOW, *Hirundo angolensis* Bacage.

Tropical migrant, which breeds in May/June. I had thought them to be passage migrants only. However, Mr. J. R. Stephenson showed me on 20.xi.65 a small colony of these birds on the next farm, where they were nesting under a rock overhung by a stream. There were about a dozen nests, in various stages of breeding; some had new laid eggs, average clutch about 3 eggs, some with small nestlings, some with large; other nests were empty; also there were nests that had survived from previous years. Seven eggs averaged 20 × 13 mm, and were marked like those of *H. rustica*. From notes of other parts of the farm where I have seen them, they appear to like fairly open country, near water, and with a suitable cliff-face to build on.

RED-RUMPED SWALLOW, *Hirundo daurica* Linnaeus.

Resident and partial migrant, as sometimes it seems to disappear for a month or two. The main breeding takes place in April and May, but it is often upset if the rains are late, and it cannot get mud for building. They sometimes start building in November, but I have not found them rearing young at this time.

MOSQUE SWALLOW, *Hirundo senegalensis* Linnaeus.

Resident and partial migrant. A fair number on the farm in April and May, when they breed, but the majority disperse and leave from August until about December.

AFRICAN SAND MARTIN, *Riparia paludicola* (Vieillot).

A common resident, which undergoes considerable local movements, as the numbers vary from hundreds to only a few. Breeds April to July.

BANDED MARTIN, *Riparia cincta* (Boddaert).

Visitor, mainly from February to July, but never common. I have seen it carrying small bits of grass in its bill, but have not yet found it breeding on the farm; however, Mr. Stephenson found a small colony breeding on the 30th June on the next farm in a murram bank near the river. There were 2-3 eggs per nest, but breeding may have been disturbed as the eggs were cold; two measured were 22 × 15 mm 23 × 16 mm. Birds are first seen about March, and these seem mainly migratory, the later ones staying to breed. By August, they have nearly all gone, and are seldom seen again before the following year.

AFRICAN ROCK MARTIN, *Ptyonoprogne fuligula* (Lichtenstein).

An occasional visitor, which is usually seen round the eaves of the house and farm buildings for a day or two, before it disappears again. This bird is resident elsewhere in the district, and it may colonise this farm eventually.

HOUSE MARTIN, *Delichon urbica* (Linnaeus).

Winter passage migrant, rather more apparent in the autumn than in the spring months, and especially when migrating. Ofton in company with swifts, and are never seen to perch. Late date 13th March.

BLACK ROUGH-WING SWALLOW, *Psalidoprocne holomelaena* (Sundevall).

Resident, normally found within a short distance from the river, and either near or in the forest. The call is a thin, pleasant "sweeeeee", something like a Sand-Martin's. I found them nesting in tunnels in hard rock by a river-bed deep in the forest in February. On the farm, they nest in murram-banks, where I imagine they excavate the holes themselves.

BLACK CUCKOO-SHRIKE, *Campephaga sulphurata* (Lichtenstein).

Visitor of uncertain status. I have only seen them on half a dozen occasions, either singly or in pairs, and they seem likely to be overlooked due to their inconspicuous habits. I have not seen a male with yellow wing shoulder.

GREY CUCKOO-SHRIKE, *Coracina caesia* (Lichtenstein).

Resident, fairly common throughout forest. In the field the bird appears entirely grey the lores, throat, wings and tail being uniform. The eye seems to have a very pale ring round it. These birds appear rather stolid and silent, but on occasions they indulge in a lot of excited chases; these take place in May and June, and again in November and December, and I believe they may breed twice a year; the only breeding record I have is of an adult feeding a mottled juvenile on 30.xi.63. The call is a very high-pitched, batlike squeak, "tsip tsip", and the song is a number of notes run together as an elaboration of the call.

LESSER GREY SHRIKE, *Lanius minor* Gmelin.

Regular winter passage migrant, which occurs only in April, with one record for the 1st May. These are conspicuous birds with strong flight which I never fail to see yearly as they make their way north through the farm in ones and twos.

FISCAL, *Lanius collaris* Linnaeus.

Common resident over the whole farm, using fences and telegraph wires where no natural perches available. Breeds January to April.

RED-BACKED SHRIKE, *Lanius collurio* Linnaeus.

Regular winter passage migrant, generally seen in April, but twice in October, viz. 27.x.62, and 31.x.63. They tend to keep nearer to the forest edge, and are more likely to be missed than *L. minor*. The migratory dates of both these shrikes are remarkably consistent.

TROPICAL BOUBOU, *Laniarius aethiopicus* (Gmelin).

Fairly common along forest edge, in the garden and up river beds. Occasionally I have seen them gather into loose noisy flocks in order to feed in a particular forest tree.

DOHERTY'S BUSH-SHRIKE, *Telophorus dohertyi* (Rothschild).

Not uncommon resident in the forest where there is enough secondary growth. Rather skulking, and keeps to the inside of a bush, and its presence is usually given away by its call, a loud ringing "wip wip-wip". This call is heard all the year, especially during the rains, and in the breeding season it adds a few notes to this whistle. It has a scolding rattle "crrrrr", and a sharp alarm note "jeb". I found two pairs with young in July 1962, and another pair with a juvenile in August.

WHITE BREASTED TIT, *Parus albiventris* Shelley.

Common throughout forest and forest edge. Often a member of mixed bird parties. Young seen in April.

[GOLDEN ORIOLE, *Oriolus oriolus* (Linnaeus).]

Three records, October 1960, and November 1964 and 1965, but not confirmed, as the birds afforded only a brief glimpse. From these dates, it would seem more likely to be this species than the African Golden Oriole.

BLACK-HEADED ORIOLE, *Oriolus larvatus* Lichtenstein.

Not uncommon, but irregular visitor generally from June to December. Frequents open woodland and garden, particularly favouring rows of pine trees, in which it finds numbers of hairy black and white caterpillars. The bird has a melodious subsong which includes a lot of mimicking, rather like a Jay's, (*Garrulus glandarius*); in spite of this I have seen no sign of breeding.

PIED CROW, *Corvus albus* Müller.

One record for a pair of birds, one visibly larger than the other, which I saw around the district for a few days in August 1965. They were severely mobbed by Black-winged Plover when they ventured too close to a breeding colony, and later I saw them a few miles away trying their luck at an African shop.

WHITE-NECKED RAVEN, *Corvultur albicollis* (Latham).

Regular visitor to farm, generally throughout the year. Mostly seen in pairs, but in February 1962 I saw 4 birds, and in February 1963 I saw 5 together, and these may have been family parties. They have a curious affinity for Tawny Eagles, which I have observed here and on Mt. Kenya. The ravens do not seem to be aggressive, but will fly wing-tip to wing-tip with the Eagles, and then sit beside them for no apparent reason.

WATTLED STARLING, *Creatophora cinerea* (Menschen).

Irregular visitor, mostly between July and December, in small numbers from 1-6, and always in company with Oxpeckers or Glossy Starlings. They seldom stay more than a few days.

VIOLET-BACKED STARLING, *Cinnyricinclus leucogaster* (Boddaert).

Rare straggler, with two records only, from the garden. Records were for single females, one on 20.vii.61, and the other on 11.viii.64.

SHARPE'S STARLING, *Pholia sharpii* (Jackson).

A spasmodic visitor, which usually arrives about December and leaves April or May, although some years it does not come at all. There is some evidence that they may breed, as at times they are found in pairs, and there is a lot of song and display. The latter includes postures like a Wryneck's, with the neck outstretched stiffly, and the bright yellow iris, (always conspicuous), appearing even more prominent. The song consists of several squeaky but not unattractive notes, which remind me of a rusty tricycle being pedalled down a cobbled street! The call note is a staccato "peek" repeated several times, and often precedes the song. One bird seen in a party of 20 in April 1961, was clearly a juvenile, with a dusky grey back, a dingy white front with a few indistinct streaks, and no golden iris. As adult birds had been seen paired in November, this juvenile might well have been born on the farm. The birds are always found in the forest or on the edge of it, and so far I have only seen them eating small berries, but they also cling to the bark of a tree like a Nuthatch *Sitta europaea* Linnaeus, and this may be to search for insects. The flight is swift and powerful, and slightly undulating.

BLUE-EARED GLOSSY STARLING, *Lamprocolius chalybaeus chalybaeus* (Hemprich & Ehrenberg).

A common, at times abundant resident which breeds in the forest in April and May, and flocks from July onwards, with up to 200 in a flock, wandering over the whole farm. The wing measures up to 155 mm so this must be the nominate race.

WALLER'S CHESTNUT-WING STARLING, *Onychognathus walleri* (Shelley).

One record of several short-tailed redwing starlings in loose company with Sharpe's Starlings flying amongst the tops of some tall forest trees. The date was April 1961.

SLENDER-BILLED CHESTNUT-WING STARLING, *Onychognathus tenuirostris* (Rüppell).

Only a few isolated records of long-tailed redwing starlings have occurred, which is curious, as only a few miles to the east, at about the same altitude, they appear to be resident and fairly common. The records are all from December to May.

RED-BILLED OXPECKER, *Buphagus erythrorhynchus* (Stanley).

Common resident. All the conditions they require exist on the farm, with plenty of undipped cattle for feeding on, and tall timber for nesting in. They appear to breed in September and October.

GREEN-WHITE-EYE, *Zosterops virens* Sundevall.

Common resident of the forest and forest edge; nearly always found in small flocks in mixed bird parties.

MALACHITE SUNBIRD, *Nectarinia famosa* (Linnaeus).

Regular visitor from about September to April. The males are in breeding dress when they arrive, and there is a lot of song so I suspect them of breeding on the farm. During the months of absence I have seen them at Njoro, (2,000 ft. lower, and 30 miles away). The song is very similar to that of the Double-Collared Sunbird, and consists of a few sharp notes, followed by a high- pitched reel. The call is a thin "tsit tsit" by both male and female. This is the least common of the Sunbirds that occur on the farm.

TACAZZE SUNBIRD, *Nectarinia tacazze* (Stanley).

A common resident, especially in the garden and the forest edge. Aggressive birds that always seem to be chasing each other or other species of Sunbirds. They make a wide variety of call notes including a sharp "tac tac" and some more squeaky. The song is either rather like a Chiffchaff's viz. "chip chip chap chip chap chap" etc., or else a harsh reel. The males appear not to undergo any change of plumage in the non-breeding season; there are at least 6 of them in the garden under observation. They seem quite promiscuous and are not seen in pairs like the Malachite or Double-Collared Sunbirds. The female builds the nest which is suspended at the end of a thin branch and made of dry grass, leaves, bits of old string etc., and lined with feathers; the nests may be from 4 ft. to 30 ft. above ground. Spiders' webs are also used in construction, and the female is often seen hovering under the eaves of the house, extracting bits of cobweb. Breeding takes place in April and May, and October to December, and once in August. This sunbird seems more insectivorous than other species, and may be seen hawking for flying insects.

GOLDEN-WINGED SUNBIRD, *Drepanorhynchus reichenowi* Fischer.

A breeding visitor, usually absent from June to August or September. Their arrival coincides with the flowering of a wild tree *Crotalaria* to which they are addicted, although they are less particular after a few weeks, when they invade the garden and remain to breed. Here they are especially fond of a heavy flowering shrub, *Streptosolen jamesonii.* They breed twice, in April and October. Their song is a loud reel, "chissississississ", rather as for other sunbirds, and their usual call note, a deep "jer-wit jer-wit". Like other montane Sunbirds, they are primarily dwellers of the forest edge where there are plenty of flowering shrubs and wild plants, but they will venture into the open when food is available. One evening in November, Mr. M. E. W. North and I witnessed a large number coming in from the grasslands to roost amid the big timber.

EASTERN DOUBLE-COLLARED SUNBIRD, *Cinnyris mediocris* Shelley.

A common resident of the forest, forest edge and garden, although only seen in pairs or with young. They frequent the green undergrowth that arises after forest fires, and seem to find their food from very small flowers; occasionally they ascend into tall trees, but I have not seen them in bird parties, as suggested in Praed and Grant. They seem to confine themselves to a very limited area. I have only seen the female building the nest, usually in April and October, once in June, but the male is a more faithful mate than other male Sunbirds, singing from a nearby perch during the building operation or following close behind while she carries the material. The call note is a soft "jeb jeb", and the female's is the same but even softer and lower in pitch. The song is composed of two or three call notes followed by a silvery reel, uttered from a prominent perch; these birds are persistent singers, and may be heard most of the year in all sorts of weather, from dawn to dark. As with the Malachite Sunbird, the pectoral tufts are not always visible; on some birds they can be seen and on others they cannot: they do not seem able to display these tufts at will. I have seen birds in magnificent fresh plumage and full nuptial song, with not a sign of the tufts; other birds in worn-out plumage creeping about in some nettles, showed the whole tuft quite distinctly.

GREY-HEADED SPARROW, *Passer griseus* (Vieillot).

Rare straggler; two occurrences, the only recorded month being June. It is curious that it should be so uncommon, when I have seen both this bird and the Rufous Sparrow ten miles to the east, at 8,000 ft.

BLACK-BILLED WEAVER, *Heterhyphantes melanogaster* (Shelley).

A very shy and retiring forest bird of doubtful status. I have recorded it from June to December, singly or in pairs, once, (October), in a small party. Their presence is often only detected by the sound of dry leaves being scratched about under a bush; their song is most curious, and seldom heard, being a whistle followed by a buzzing reel and then a series of clicks, the whole being uttered extremely rapidly and possibly by two birds. The call is a sharp "preet preet", seldom heard. Probably the bird is resident a little further inside the forest, where the undergrowth is thicker. The party I saw in October appeared to include young birds with dusky plumage, and from this and the dates recorded for song, I would conclude that they breed in August or September.

REICHENOW'S WEAVER, *Othyphantes reichenowi* (Fischer).

A common resident, especially around the garden and near cultivations. From the face markings of the male, it seems that the nominate race is the one that occurs here. I have seen three or four xanthochroic individuals on the farm, and with their bright golden backs

they look like miniature Orioles. This Weaver is found in parties of up to 30 birds, but the male and female of a pair usually keep close together. They breed during most of the year, especially in January, April and October.

BROWN-CAPPED WEAVER, *Phormoplectes insignis* (Sharpe).

An uncommon resident found along the forest edge, which appears to undergo some local movement. It is invariably found in pairs or with young. Their manner of feeding and the way they climb about the branches are reminiscent of the Nuthatch *Sitta europaea* Linnaeus. Their normal call is a soft conversational "tuk tuk tuk", but with young they make a loud "chwee chwee". The song is simple and mainly consists of a soft buzzing reel like that of the Black-Billed Weaver. Young birds have been seen in March, September and December, and as they do not appear to stay long in company with their parents, the breeding dates would be about a month earlier in each case.

GROSBEAK WEAVER, *Amblyospiza albifrons* (Vigors).

A rare straggler, one recorded only. Mr. Arthur Loveridge and I found this bird nesting on the Narok dam in May 1960, which is much lower, but only about 30 miles away. The single bird I saw on the farm was flying into a strong wind on 28.1.65, due east, and appeared to be migrating. It paused for a moment at the top of a pine tree and then flew on again.

RED-BILLED QUELEA, *Quelea quelea* (Linnaeus).

Fortunately the Queleas are rare stragglers to this wheat-growing district, where they might do immense damage. They are usually seen two or three at a time, and are in non-breeding plumage, which makes them hard to identify. This is the commoner of the two queleas so far confirmed.

CARDINAL QUELEA, *Quelea cardinalis* (Hartlaub).

Rare straggler.

RED-NAPED WIDOW-BIRD, *Coliuspasser laticauda* (Lichtenstein).

Visitor from October to December, generally only in small numbers. Although the males are in full breeding dress during this period, I have seen no signs of nesting. The song is like the noise of a miniature sewing-machine, and is uttered in flight.

JACKSON'S WIDOW-BIRD, *Drepanoplectes jacksoni* Sharpe.

A common resident in the grassy valleys, especially near dams. They undergo some local migrations in the dry season from January to March, when most of the males are in non-breeding dress. Nesting seems to take place from April to October, and birds become dispersed over a wide area, flocking into hundreds when breeding has finished.

GREY-HEADED NEGRO-FINCH, *Nigrita canicapilla* (Strickland).

I have only seen this bird three times so it must be rare. The birds were seen on the forest edge near the river. Another time I saw a small party a mile away, deep in the Masai forest, in August.

RED-FACED CRIMSON-WING, *Cryptospiza reichenovii* (Hartlaub).

Only three definite records, but there is some confusion between this and the next species, especially with females and juveniles. However, on 18.x.60, I saw with binoculars, a crimson-wing at close quarters, perched on a low tree, with a piece of dry grass in its bill. Jackson's description of *C. salvadorii,* states that the eyelids are red, but how clearly these would show in the field I am not sure; this bird and the other two recorded had the red lores as well. Other birds seen with an impression of red around the eye I have discounted, as they may well have been *C. salvadorii;* some birds even seem to have the iris red.

ABYSSINIAN CRIMSON-WING, *Cryptospiza salvadorii* Reichenow.

Fairly common resident. Very active little birds generally seen darting about in the forest making their soft "chip chip" call-note. Usually in small numbers, or pairs, but after August may be found in flocks of up to 50 when they feed on tall grasses on the edge of cultivations.

QUAIL-FINCH, *Ortygospiza atricollis* (Vieillot).

Uncommon visitor. Occurred from December 1962 to March 1963, and again November/ December 1965, when it was seen on grassland and stubbles in pairs or parties up to six. They

were very shy, seldom allowing a close approach, and it took a long time to identify them; the cail-note, tiny size and pale margins to the tail feathers were distinctive features.

YELLOW-BELLIED WAXBILL, *Coccopygia melanotis* (Temminck).

Resident and local migrant in small numbers. Most common in August, when small parties of up to 20 birds are seen, and when I have seen them carrying nesting material. Their call is a high, thin "seep seep seeip see-ip".

WAXBILL, *Estrilda astrild* (Linnaeus).

Common resident on the grasslands near water. On one occasion I heard a single bird uttering a definite song, but I have no written description of it. In flocks of up to 50.

YELLOW-CROWNED CANARY *Serinus flavivertex* (Blanford).

A very common resident, found all over the farm. It occurs in small and large flocks, sometimes in many hundreds. It is a very persistent singer, singing from the tops of the tallest cedar trees even in high winds. The song consists of a few short notes followed by a continuous reel for many minutes, when the bird pauses briefly, and then starts again. Breeding takes place chiefly in October.

STREAKY SEED-EATER, *Serinus striolatus* (Rüppell).

Very common and ubiquitous resident. They are a nuisance in the garden, where they destroy flowers and seedlings, and in the stores where they make holes in the grain sacks, spilling large amounts of grain. They breed most of the year round; I have not found more than two eggs or young in a nest. They have a variety of call notes, the most usual being a quick "sirrup", another being a harsher "shwee-ip". The song is hardly "reminiscent of a Bulbul" as suggested by Praed and Grant, but it is more typically finchlike.

THICK-BILLED SEED-EATER, *Serinus burtoni* (Gray).

A fairly common resident, found in the forest and in small trees along the forest edge; occasionally it is met with out in the open. In silhouette its stocky build and stout bill remind one of a Hawfinch *Coccothraustes coccothraustes* (Linnaeus). Lack of white on forehead or throat identify the race as *gurneti* (Gyldenstolpe). The call-note is a high, sibilant "syip syip", and as they usually feed with hardly a movement, their call is the first indication of their presence. The song is only heard in what is presumably the breeding season, i.e., July, and is a pleasant "sippi swee swee sippi swee". The birds are found in small parties of 6 to 7, but once I found 30 of them moving across more open country, indicating some local migration.

AFRICAN CITRIL, *Carduelis citrinelloides* (Rüppell).

Fairly common resident, but never in flocks of more than a dozen, and often in pairs. Mostly found along the forest edge, where it feeds especially on tall thistles. The call note is a single very high squeak, almost inaudible. The song is very characteristic: a three-note whistle, "pee per pee"; sometimes an extra note is tacked on the end. The only time I observed a variation was when I saw a male displaying to a female; perched high up in a tree, he sang a long trill like a Canary, throwing his head right back and fluttering his wings. The female in this instance paid no attention, but on another occasion, a female crouched on a twig, and with much wing-fluttering, begged for food, which the male pretended to give her. Breeding records, May and December.

CINNAMON-BREASTED ROCK-BUNTING, *Fringillaria tahapisi* A. Smith.

The only buntings I have seen here were two of these birds on a murram bank on the 6.xi.65. Neither showed much black on head or chin, and they may have been immature.

Summary of species identified on the farm

(i) *Breeding*

Regular breeding residents, some moving off the farm in non-breeding season:	84
Migrants which breed on the farm, then leave:	15
Total breeding species	99

(ii) *Non-breeding visitors or migrants*

From within Africa, regular	36
From within Africa, irregular	62
Palaeartic winter migrants	53
Total non-breeding species	151

Acknowledgments

I am most grateful to Mr. M. E. W. North for encouraging me to write this paper in the first place, for reading over the manuscript and commenting on it, and in general for assisting me with his invaluable experience; he has also generously allowed me to use his habitat photographs of the farm. Mr. J. G. Williams has very kindly identified the specimens I have sent him, and Mr. Leslie Brown gave me many helpful suggestions concerning the birds of prey. Many neighbours have helped by reporting various species seen on their farms, especially Mr. and Mrs. Grainger, Mr. and Mrs. Daniell, Mr. and Mrs. Hamilton-Fletcher, Mr. and Mrs. Lutyens, and Mr. J. R. Shephenson, who found the nests of the Mackinder's Owl, the Angola Swallow and the Banded Martin. Mrs. Elizabeth Nicoll kindly made a competent job of typing out a very untidy manuscript.

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(Received for publication 25th April, 1966)

PLATE 1. Forest canopy, showing Crowned Hawk-Eagle's nest in dead cedar tree.
(Photo by M. E. W. North).

PLATE 2 View of cultivated land with two Masai hills in the background
(Photo by M. E. W. North).

PLATE 3. Rocky valley, showing cedar tree where Mackinder's Owl roosts. (Photo by M. E. W. North)

PLATE 4. Young Mackinder's Owl just able to fly. The white part round the gape is particularly evident in poor light.

RHINOPTERA JAVANICA MULLER & HENLE FROM KENYA WATERS (PISCES : RHINOPTERIDAE)

By

G. F. Losse

East African Marine Fisheries Research Organization, Zanzibar

Rays of the family Rhinopteridae, commonly known as cow or bull rays, are rare in East African waters. Few are caught and none have been recorded previously by the East African Marine Fisheries Research Organization in Zanzibar. It was therefore of interest when two specimens of *Rhinoptera javanica* Müller & Henle were caught in a shark tangle-net set at the edge of a coral reef off Kikambala, Mombasa district, in March 1965. One of these speciments was purchased and is described below.

I would like to thank Mr. Peter Nicholas of Mombasa for supplying the specimen and catch data and Dr. J. F. C. Schwartz of Maryland University (U.S.A.) for confirming the identification.

RHINOPTERA JAVANICA Muller & Henle, 1841.

Rhinoptera javanica Müller & Henle, 1841, *Syst. Beschr. Plagiostomen:* 182, pl. 58 (type locality: Java); Day, 1878, *Fishes of India:* 744, pl. 195, fig 4 (teeth) (India); Fowler, 1941, *Bull. U.S. nat. Mus., No. 100:* 476 (references; Pacific specimens); Smith, 1953-1965, *Sea Fishes Southern Africa:* 504, fig. 77a (South Africa); *Idem,* 1958, in *Natural History of Inhaca Island, Mocambique:* 131 (Inhaca, Mocambique); Fourmanoir, 1964, *Cahiers — ORSTOM, oceanogr., No. 6:* 40, pl. 7 (Madagascar).

Rhinoptera jayakari Boulenger, 1895, *Ann. Mag. nat. Hist.,* (6) 15: 141 (Muskat, Arabia).

DESCRIPTION: Based on the single specimen, 1194 mm. total length (head notch to tip of tail), a male approximately 26 lb. in weight from Kikambala, Mombasa district.

Body, head and pectoral fins form a broad lozenge-shaped disc. Head distinct, divided into two lobes by a deep median anterior notch. A pair of rostral fins not joined with front of skull and not continuous at sides of head with pectoral fins. Upper lip of mouth with a fringed edge, lower lip with numerous small papillae. Eyes prominent, placed laterally. Spiracles large, close behind eyes and open laterally. Gill openings of moderate size, the last smallest. Pectorals falcate, the leading edges convex, the hind edges concave. Dorsal fin set above basal part of tail.

Pelvic fins long and narrow. Anal fin absent. Tail long, slender and whiplike with a single basal serrated spine.

Teeth wide, angular and flat, set in pavement; nine rows in each jaw, the median row the widest, the outer narrowest. Skin smooth, without dermal denticles or tubercles; minute denticles on rostral fins.

Disc width 872 mm. (across pectoral fins), length 560 mm. (head notch to hind border of pectoral); maximum body depth 105 mm.; pre-oral distance 91 mm. (from head notch); pre-nasal distance 63.5 mm. (from head notch); eye diameter 30 mm.; inter-orbital distance 106 mm.; inter-spiracular distance 125 mm.; pre-pelvic distance 91 mm. (from head notch); dorsal fin base 58 mm., height 69 mm.; pelvic fin length 127 mm.; clasper length 114 mm.; tail length 322 mm. (? broken); serrated spine, length 54 mm., maximum width 7 mm.
COLOUR: *Fresh*, upper surfaces uniformly bluish-grey, ventral surface of disc greyish-white, darker towards tip of pectoral fins. Rostral fin denticles black.

DISTRIBUTION: Kenya (Mombasa district). Elsewhere, Indo-Pacific region; recorded from South Africa, Madagascar, Mozambique, Arabia, India, Ceylon, East Indies and China.

REMARKS: Two Indo-Pacific species are generally recognised, *R. javanica* and *R. adspersa* M. & H. These have been distinguished primarily on the presence or absence of dermal denticles or tubercles on the dorsal surface (i.e. back rough, tuberculate or smooth), and on the number of tooth rows in the jaws. Thus, Day (1878) and Fowler (1941) follow Müller and Henle (1841) and describe the dental formulae for *R. javanica* and *R. adspersa* as 7/7 and 9/7 respectively. That there must be some variation in the dental pattern is shown by the Kenya specimen with 9/9 tooth rows. I have now been informed by Dr. Schwartz *(in litt.)* that the dental formula of *R. javanica* may indeed vary from 7/7 to 9/9, or a combination of these. There is apparently but a single specimen of *R. adspersa* in existence (a stuffed mount in the Paris Museum); in this specimen the dorsal surface is warty or tuberculate.

Boulenger's (1895) description of *R. jayakari* from Muscat (nine tooth rows in each jaw, skin smooth) is very close to the specimen described here and may be regarded as a synonym of *R. javanica.*

Additional specimens of *Rhinoptera* are required from East African waters for further studies.

(Received for publication 3rd June, 1966)

PROPHYLLS AND BRANCHING IN CYPERACEAE

By

R. Wheeler Haines

Department of Anatomy,
Medical School,
Makerere University College
Kampala (Uganda)

Introduction

The prophylls of Cyperaceae have been discussed in a full paper by Blaser (1944), and others, particularly Holttum (1948), Koyama (1961) and Kern (1962), have considered them in relation to spikelet structure and phylogeny. But they do not usually figure in taxonomic descriptions or drawings and are still relatively little known, particularly as regards their distribution in the whole plant.

Here a few Nigerian species growing in the forest zone near Lagos, supplemented by a few plants from elsewhere, are used to illustrate their range of development and their bearing on the evolution of the family. Most of these species are also found in East Africa. The proper identification of the prophylls and the branch systems associated with them underlies many problems of morphology and classification.

In dicotyledons the prophyll or prophylls are taken to be the first leaf or leaves of the shoot, which may be modified in various ways but usually grade into the foliage leaves. In monocotyledons a particular form of prophyll is often found at the base of the shoot, never more than one, always placed dorsally, that is between the shoot and its parent axis, and usually having two more or less equally developed main vascular bundles each with its own keel rather than the single main bundle and single keel of the foliage leaves. It is this unique organ, well developed in Cyperaceae, that is considered in this paper.

I have to thank Miss S. Hooper, of the Kew herbarium, for identifying most of the material, and for her kindly guidance through the literature of the subject.

Tubular Prophylls

Fimbristylis obtusifolia (Lam.) Kunth (fig. 1, B-E) is a common tufted perennial of open trodden ground near ponds and lagoons. The foliage

leaves are all basal, but some ensheathe the lower part of the rounded culm (B and C). New branches spring as buds from the axis of the leaves, the three branches *a*, *b* and *c* of the fragment shown from the leaves, 3, 4 and 7 of the parent stem. At its base each branch is surrounded by a tubular prophyll, a^p, b^p and c^p. The prophyll carries a pair of ciliate keels ending in short points, and these keels embrace the parent axis (D). As the shoot expands the prophyll is often split to the base on the abaxial side (E). The prophyll is followed by a variable number of foliage leaves arranged spirally, and these, at the culm apex, by the bracts that subtend the branches of the inflorescence.

Fimbristylis obtusifolia has a condensed inflorescence not suitable for analysis, but in *F. dichotoma* (L.) Vahl, a common weed, usually annual, of gassy places, banks and fields, the parts are well spread (fig 1, A and F-L). The lowest bract (F-H, *b*) is longer and set more vertically than the others, and subtends the longest and most complex branch (I), while the succeeding bracts, set, as in most Cyperaceae, at near limit divergence (Hirmer, 1931), decrease regularly in size and bear less complex branches. Each branch is surrounded at its base by a tubular, two-keeled prophyll (I.J) similar to, but much smaller than those at the bases of the culms. The lower branches (1 and 2) are themselves further branched, the upper not so. Each branch ends in a terminal spikelet with the secondary branches, if any, springing immediately below (K,L). The glumes of the terminal spikelet follow the spiral of the bracts without interruption (H,L). One spikelet is terminal to the culm itself and is sessile amongst the major branches (A and G, *t*), and so lies near the base of the whole inflorescence.

In *Fimbristylis dichotoma* the branching at the base resembles that in *F. obtusifolia*, but the lower leaves are reduced to short-bladed sheaths. The leaves have a sub-distichous arrangement, so that the branching comes to be largely in one plane (fig. 2, F and G). In the fragment analysed the leaves a^4 and a^5 of the oldest shoot subtend shoots *b* and *f*, while a^2 has the prophyll of an undeveloped shoot e^p hidden in its axil. The shoot *c* is subtended by the leaf b^2 and *d* by c^2 in succession so that all the prophylls of this side of the fragment face towards *a*. But on the other side the shoot *g* is subtended by f^3 and its prophyll faces the other way, spoiling the symmetry.

Within the spikelet glumes there are no prophylls: nothing corresponding to the paleas of Gramineae. Since every shoot of the plant, from the largest culm axis to the smallest branch, carries a prophyll at its base and a spikelet at its apex, the numbers of prophylls and spikelets over the plant as a whole are, in principle, equal. But while the spikelet of a minor branch lies near its prophyll and its glumes follow the prophyll immediately (fig. 1, K, L), the terminal spikelet of the infloressence is

separated from its prophyll by the whole length of the culm, and there are many foliage leaves and inflorescence bracts between.

In *Eleocharis mutata* Roem. & Schultes (fig. 2, H, I) the culm ends without branching in a single spikelet, so that there are normally no prophylls except at the culm bases, where they are constant. In the normal spikelet there are no prophylls, nor are they found at any stage of development (Mora, 1960, *Eleocharis palustris* R. Br.). But in proliferating spikelets of *Eleocharis,* sect. *Multicaules* where the florets are replaced by vegetative shoots, Koyama (1961) found them, the only clearly recorded examples of intraspicular prophylls in Cyperaceae.

The *Fimbristylis* species discussed seem, so far as their branch-systems and prophylls are concerned, fair samples of unspecialized Scirpeae. It is generally agreed that the presence of perianth bristles and the relatively simple insertion of the floret in *Scirpus* are more primitive characters than the absence of bristles and winged rachilla of *Fimbristylis* (Koyama, 1961). The branch structure in *S. sylvaticus* L., picked by Monoyer (1934) as the nearest approach in living material to a primitive *Scirpus,* is similar to that in *Fimbristylis.* In *S. pedicellatus* Fernald Blaser (1944), found a gradual transition from a large two-keeled many-veined prophyll of the lowest ray of the umbel to the smallest type which was hyaline and usually without keels or veins. Blaser also noted that in the species of *Scirpus* he examined the prophyll never subtended an axillary bud. A fragment of *S. brachyceras* Hochst. (fig. 2, J), however, shows one prophyll (*a*) at the base of the branch, and others (*b*, *c*) at the bases of the latest spikelets. In the axil of *a* is an undeveloped spikelet, with its own prophyll (*d*), and similarly placed spikelets may become fully developed.

Prophyll branching at the plant base

Fimbristylis hispidula (Vahl) Kunth is a tufted, hairy, fast growing annual of dry disturbed places (fig. 2, A-E). The leaves are relatively reduced, the culms serving as the main assimilating organs. The inflorescence is usually less complex than in *F. dichotoma* and is often without secondary branching, as in the head figured by Nelmes and Baldwin (1952), but is of the same structure, with tubular prophylls (E).

At the base of the plant the prophylls are closely packed and conspicuous, and most of the new shoots spring from their axils. A prophyll subtends one shoot, and the prophyll of this shoot the next, without waiting for the parent shoot to mature, a process which leads to a mass of shoots and prophylls facing in different ways (B, C). The young prophylls are conical with only a narrow opening (D) but become split as the shoot expands. Such basal prophyll branching is uncommon but in *Eleocharis*

acicularis (L.) Roem. & Schultes, and E. *palustris* (L.) R. Br. tuft formation in the season following establishment of a new plant depends on this mechanism (Tutin, 1954; Mora, 1960).

Prophyll branching in the inflorescence

Fuirena umbellata Rottb. (fig. 3, A-O) is a soft-stemmed upright plant of wet places and streamsides, often, at least at flood time, partly submerged. The rhizome is creeping, made up of the horizontal bases of successive shoots. The stem is eventually ascending with the leaves spaced along it, the lower reduced to sheaths, the upper foliaceous. The spikelets are set in clusters of about six, arranged in an elongate inflorescence. New shoots break through the bases of the old scale leaves (B), protected at first by short conical prophylls which are split as the shoots expand (C, D), and soon wither. Usually only one such shoot develops from each old stem, but several buds are formed, and these may develop to give a branching rhizome.

The leaves below the inflorescence subtend no branches, nor can any trace of buds be found in their axils. But in the flower bearing region two branches, a major and a minor, appear at the ligule margin of each of the larger bracts (E and F, *mj*, *mn*). Traced to their origins at the bract attachment the two branches are found enclosed together in a delicate tubular prophyll (G), and the minor branch has, besides, its own prophyll (H), arranged as shown in the plan (I). Thus the minor branch springs from the axil of the prophyll of the major branch.

Tubular prophylls similar to those of *Fimbristylis* also surround the smaller branches of the inflorescence (J). But in *Fuirena* the individual spikelets are sessile in the cluster, and their prophylls are shortened so as to be wider than long (K). Further each prophyll bears on its adaxial surface a pulvinus which swells as the inflorescence reaches maturity so as to force each branch or spikelet away from the axis that carries it. At maturity the prophyll persists at the base of the spikelet rachilla while the glumes and nutlets fall from it (L).

Here again the numbers of prophylls and spikelets correspond. The scheme (M) represents the spikelets carried at a single node. The major and minor branches each have a prophyll at the base and end in a terminal spikelet (*t*) which occupies the centre of a cluster and has no prophyll at its base. The other spikelets are arranged in spiral order, each subtended by a bract and each bearing a prophyll at its base. The distinction between bracts, prophylls and glumes is clear. Occasionally, as in the axil of the bract b^4, a spikelet (*in*) may spring from the prophyll of another spikelet. Another example, this time aborted, is seen at the base of the fruiting

spikelet (L, *in*), with its own prophyll. But whereas prophyll branching is an important feature of the main branch system of the inflorescence, it is relatively rare in the spikelet clusters.

Owing to the elongation of the internodes of the main stem the terminal spikelet of the inflorescence lies near its apex (E, *t*). It does not usually lie quite at the apex, for the uppermost part of the main stem is deflected and a secondary branch continues its direction.

The floret in this species has three perianth scales, of which the largest lies between the ovary and the rachilla of the spikelet (N, O), so in the position of a prophyll. But it is not two-keeled, and its texture and veining agree with those of the two smaller scales. Further all three scales end in a weak, flexuous bristle, suggesting that the wide basal part of the scale is an expansion of a bristle such as is found in many Scirpeae (fig. 2, I) and, in species of *Fuirena* with six perianth members, in the outer three.

Nees Van Essenbach (1835) believed that the three scales of *Fuirena* were attached within the three stamens and Kern (1962) was also 'pretty sure' that the scales were inside the whorl of stamens. If this were indeed the case the scales could not belong to a perianth and would presumably be bracts. So Mattfeld (1938) and Kern (1962) took each separate stamen in *Fuirena* as a unisexual flower subtended by a bristle, and the ovary as a terminal female flower, the whole bisexual structure being a composite 'synanthium'. They accepted the implication that the florets of other Scirpeae must, since their structure was rather similar, also be synanthia.

But though the filaments of the stamens lie outside the scales both Blaser's (1941, a) beautiful sections and my dissections of fresh material (fig. 3, N) show their attachments at most on a level with the perianth segments and not outside them. There is then no need to consider these florets as synanthia. It seems probable that the many peculiarities of *Fuirena umbellata*, its various types of prophyll with and without a pulvinus, prophyll branching, hollow 5-angled stems and leaf with ligule and adjustor tissue, are, together with the scaly perianth, all specializations. It is more difficult to decide whether the long internode of the culm and shorter internodes of the inflorescence in *Fimbristylis*, or the more uniformly expanded internodes giving the leafy stem and elongated inflorescence of *Fuirena* are the more primitive, or whether both are derived from yet another arrangement.

Dulichium has also been interpreted by Mattfeld (1938), Schultze-Motel (1959) and Kern (1962), as having synanthial florets. Of the 8 bristles the 5 abaxial are inserted below the stamens but the 3 abaxial above. Each group of bristles was interpreted by Mattfeld as the surviving veins of a dissected bract, but Blaser (1944) found the anatomy

of the floret to be of normal scirpoid type, except that the inner bristles were a little displaced, presumably by pressure in the bud. Kern pointed out that neither of the two groups of bristles could be a reduced prophyll as in Cyperaceae the prophylls have no midveins, but still believed that the bristles were reduced bracts, not perianth segments.

In fact Blaser's (1944) figures of prophylls at the base of a major branch and of a spikelet, taken together with Schultze-Motel's (1959) figures of the lowest floret of a spikelet which includes the prophyll (unlabelled) at the spikelet base, show *Dulichium* to be, in general structure, of ordinary scirpoid type. Koyama (1961) has removed it from Cypereae to Scirpeae in spite of the distichous glumes, which may be found in other Scirpeae such as *Scirpus roylei* (Nees) A. A. Beetle and several species of *Fimbristylis* and *Bulbostylis*. Indeed this and other characters such as the cylindrical hollow stems, the evenly spaced equal inflorescence branches, and the shift of the inner bristle suggest a peculiarly specialised type, rather than a relatively primitive form, 'combining characters of Scirpeae, Cypereae and Rhynchosporeae', as suggested by Mattfeld. A new study of the plant as a whole is needed.

Serial branching

Though *Fuirena umbellata* usually grows in swamps, it is sometimes found in open places which dry out each year for several months. In this case the rhizomes are straight, with only occasional branches, and are studded with closely packed, hard, black 'bulbs' (fig. 3 P,Q), which sprout at a favourable opportunity. The 'bulbs' lie alternately to the left and right of the sympodial rhizome, and the leaves are set in alternate right and left-handed spirals (arrows in R). Successive branching from the second leaves, f^2, g^2, h^2, etc. gives the straight rhizome with two scales, the first and second leaves of the succeeding culm, between each pair of 'bulbs'. These two scales are intact only in the last shoot *j*. In the others they are split as the succeeding shoot develops. The third leaf of each shoot makes the outer covering of its 'bulb'. Such 'serial' growth is rare in Scirpeae, but is found in many Cypereae, always dependant on budding from the axil of the second leaf. Buds may be found in the axils of other leaves, as h^4, giving branching rhizomes.

Prophylls in Cypereae

Cyperus tenuis Swartz (fig. 4, A-H) is common tufted weed of grassy clearings and pathsides in dry, disturbed bush, usually dying off in the dry season. The base of the culm is swollen (B) and carries a variable number of scale and foliage leaves. The lower leaves are split (C) so that it is

difficult to place them, but when they are torn off their positions become clear from the arrangement of the buds developed in their axils. The strictly $\frac{1}{3}$ phyllotaxy, found in all Cyperaceae with sharply triquetrous culms, is attested by three vertical series of buds, each protected by a conical prophyll (B). The tristichy is derived from a distichy in the seedling (Hirmer, 1931).

The primary and secondary umbel branches have tubular, two-keeled bifid prophylls (D,E), resembling those of a *Fimbristylis*. But at the attachment of the prophyll, and probably a part of the prophyll, is a pulvinus which adjusts the position of both the branch and the umbel bract that subtends it. This action is fully discussed by Mora (1960) for *Cyperus papyrus* L., where each of the larger bracts subtends many branches set side by side like a hand of bananas, each branch with its own prophyll. In *Fimbristylis* some of the spikelets are solitary, others grouped into small clusters. This is a common arrangement in other general of Scirpeae, but in some, such as *Holoschoenus*, all the spikelets are grouped. In *Cyperus* the unit is a group, most of the groups carried in the secondary umbels, but some solitary on the shorter branches and one terminal to the culm.

In the group one spikelet is terminal, the rest lateral (F,G). Each lateral spikelet has two empty scales at its base, one the subtending bract (*b*), the other the prophyll (*p*), followed immediately by the fertile glumes. The prophyll is scale-like, the tip entire, the keels hardly distinguishable and the pulvinus confined to the adaxial surface (H), so that it has little resemblance to the prophylls of the umbel rays.

The terminal spikelet (*t*) is, like the lateral, sessile, and is often pushed to one side by the uppermost prophyll. It has one empty scale (*R*) at the base, presumably an empty glume, an exception to the general statement that there are no empty glumes in *Cyperus*. Similar arrangements, with sharp differentiation of the different kinds of prophyll, have been found in other species of *Cyperus* examined.

Cyperus subumbellatus Kukenth., another common weed of open, well drained places, has rounded stems, and the scales and leaves follow an indeterminate phylotaxy (fig. 4, I, J). The fragment illustrated, part of a large clump, illustrates the arrangement well. The parent shoot bears leaves labelled arbitrarily a^1, a^2, a^3 etc., and of these a^2, a^3, and a^4 subtend buds. That in the axil of a^3 is expanded and has burst through its subtending leaf. It bears a two-keeled prophyll *p* and the leaves 2, 3, 4, etc.

Now it has been claimed by several authors whose work is summarized by Arber (1934), with important additions of her own, that where the prophyll has two keels one is the original midrib of the prophyll and

the other an enlarged lateral. Supposing that the angles between successive leaves remain relatively constant, then following the series 4,3,2,p, down the shoot, the keel x not y appears as the midrib. Blaser (1944) has objected to Arber's suggestion on the grounds that her main criterion for distinguishing the keels was that of size, and 'many of her figures show the largest vein in the wrong keel'. But her claim that not more than one shoot is subtended by a prophyll, and that this shoot springs opposite the keel representing the midrib still stands, and is true of most Cyperaceae.

The prophyll a part of the disseminule

In all Scirpeae and in most Cypereae the glumes fall away from the persistant rachilla of the spikelet to set free the fruits. But in some species of *Cyperus* of the section *Mariscus*, including C. *subumbellatus*. the spikelet falls as a whole. The spikelets are arranged in dense clusters (fig. 4, K), the clusters mostly pedunculate but with a single sessile cluster terminal to the culm. Each individual lateral spikelet has a subtending bract and prophyll at its base (L). On ripening the spikelet falls away taking the prophyll with it, but usually leaving the subtending bract behind. The prophyll is not actually attached to the spikelet, and can be teased away, but clasps the base of the spikelet tightly.

In *Kyllinga*, possibly derived from a *Mariscus* by further concentration of the inflorescence and reduction of the stigmas, the disseminule again falls with the clasping prophyll (Fig. 4, M,N.). In *Lipocarpha* the prophyll may be five-ribbed, but only two of the ribs are of vascular structure (Blaser, 1944) or it may be smooth surfaced without ribs or keel. *Hemicarpha* and *Remirea* are related (Kern, 1962). *Ascolepis* (fig. 4, O,P, *A. capensis* Ridl.) is usually placed in Mapanieae, separated from other genera by the chypogynous scales' or 'bracteoles' being 'united' to enclose the otherwise naked flower. But there is no reason to believe that the enclosing structure has resulted from a union, for it occupies the position and has the two keels of the prophyll normally found at the spikelet base in sedges. All these genera may belong to Cypereae, to the group defined by Nees von Essenbach (1835, group I b) as having 'spiculae uniflorae'. Possibly in *Isolepis* also the single median hypogynous scale figured by Clarke (1909) is a prophyll and the genus belongs in Cypereae rather than Scirpeae, a suggestion which follows Pax (1886), who associated it with *Hemicarpha*. This is a rare instance of doubt as to whether or not a particular scale is a prophyll, and so as to how much of the inflorescence constitutes a spikelet.

Geometrical branching in Kyllinga

The excellent habit drawing of *Kyllinga erecta* Schum. Thonn. in the Flora of West Tropical Africa shows the straight knotted rhizome with two scales between the origins of successive culms, and my fig. 4, Q, R presents an analysis of a fragment. As in the bulbous variety of *Fuirena umbellata* the scales are a prophyll and a second leaf, and the direction of the phyllotaxy is reversed at each new shoot. Besides the main buds continuing the rhizome from the axils of each second leaf, other buds are found in the axils of the third and fourth leaves of each shoot.

In this *Kyllinga* the internodes of the horizontal parts of the shoots that build the rhizome are well developed, though the internodes at the bases of the culms are short so that the leaf attachments are crowded. In other Cyperaceae with horizontal rhizomes there may be only one internode between successive culms, so that the rhizome bears only prophylls, as in *Eleocharis palustris* (Walters, 1950), or four with a prophyll and three scales as in *Scirpus lacustris* L. (Mora, 1960). In Cyperaceae which spread by long horizontal rhizomes bearing tubers at their ends, each rhizome has a prophyll at its base and an indefinite number of elongated internodes in its horizontal part (Pax, 1886).

Leafy stems in Cyperaceae

Most Cypereae have all the stem leaves attached at the base of the culm, but in *Cyperus mundtii* Kunth. there are long horizontal leafy stems, usually half-floating in slowly moving water, clothed throughout with evenly spaced leaves. Still leafy each stem eventually becomes vertical and ends in a short bare culm and inflorescence. Occasional new branches, each with its prophyll (fig. 4, S) spring from the horizontal parts. *Remirea maritima* Aubl. has a similar spreading habit but grows in loose coastal sand. The leaves are reduced to scales on the horizontal parts; on the short vertical parts the leaves are tightly packed, and there is no bare culm between the leaves and inflorescence. These peculiar species are undoubtedly specialised and indicate at least the possibility of a culm becoming leafy. But in other tribes the direction of evolution is less certain, and the habit of the early Cyperaceae cannot be determined.

Prophyll branching in the inflorescence of Rhynchospora

Rhynchospora corymbosa Britten (Fig. 5, A-K) grows in the shallow waters of open swamps to about 2 m, usually in pure stand. The long coarse leaves are mostly basal, but others spring from the culm, and there is no gap between these and the inflorescence bract. Each major inflorescence

branch has a delicate tubular prophyll, minutely denticulate on the keels, at its base, hidden in the sheath of the subtending leaf (B).

Whereas in most sedges all the spikelets of a given inforescence are at about the same stage of development, in this *Rhynchospora* young and fruiting spikelets are mixed (C and D, young spikelets 3, 5 and 7). The culm, once it is developed, continues to bear new spikelets, and may survive the dry season to fruit again later, all with little change in its outward appearance. This is done by prophyll branching. The smaller fragment (E, F) has three successive branches with prophylls a^p, b^p, and c^p, and the larger fragment (C, D) includes the spikelet t terminal to the branch bearing the prophyll t^p, at its base, and four bracts, each of which subtends a shoot, 1, 4, 6 and 8. From the prophylls of these spring 2, 5 and 6 and from the prophyll of 2 shoot 3. Blaser (1944) gives a section of *Rhynchospora inexpansa* Vahl with a similar arrangement.

In the dwarf *Rhynchospora alba* (L.) Vahl (fig. 5, L-T, Irish material) the leaves are distichous and some subtend young shoots. In each shoot the prophyll faces the parent stem, but the new distichy is at right angles to the old. The culm leaves subtend no buds below the inflorescence, whose major branches bear long tubular prophylls (P), reduced to scales in the minor branches (Q, R). Blaser (1944) studied this species and found the smaller prophylls veinless and only slightly keeled, but had no doubt as to their identity.

Tandem branching in Cladium

Cladium mariscus R. Br. (Fig. 6, A-H, Irish material) is tall and rough approaching in habit our larger tropical sedges, though of temperate regions. In the inflorescence two branches, major and minor, noted by Mora (1960), spring from each node of the culm (*mj*, *mn*), as in *Fuirena*. The prophylls of these branches are not tubular as in most sedges, but are split to the base ventrally, with the edges overlapping. The minor branch is set in tandem ventral to the major, not at its side and not enclosed in its prophyll. The spikelets are crowded (D, E) but their arrangement is normal, each of the lateral spikelets having a bract and prophyll at its base, the terminal spikelet neither.

Loss of prophylls in Schoenus

Schoenus nigricans L. (Fig. 6, I-M, Irish material) has long, open, membranous pointed prophylls at the base (I). In the fragment figured the main stem has formed its culm, and this carries leaves a^1-a^5. Of these a^3 and a^4 subtend shoots. The prophyll of the younger shoot, b^p, is still entire but that of the older shoot, c^p, is split into two single keeled halves.

The inforescence is carried on a long bare culm which becomes bracteate near its apex. Groups of spikelets spring from the axils of the larger bracts each spikelet on a distinct pedicel, but without a prophyll (Mora, 1960 and Fig. 6 J). Slight differences of size, position and state of development suggest successive prophyll branching (K), as at the base of *Fimbristylis hispidula* Kunth, *b* developing from *a* and giving rise to *c* and *d*, but it is difficult to be sure. Near the apex of the inflorescence the bracts are smaller and subtend only one spikelet. As there are no prophylls the terminal and lateral spikelets are similar (L, M).

The spikelet in Rhynchosporeae

A terminal spikelet of *Rhynchospora corymbosa* (fig. 5 G) has three empty glumes 1, 2 and 3 at the base, and removal of glume 4 (H) does not expose a flower. But the next glume 5 which hides the lowest flower from view does not subtend it, for the glume and flower lie on opposite sides of the rachilla. In fact this flower is subtended by 4, but is closely enwrapped by the overlapping membranous margins of 5. Similarly removal of 5 does not expose the next flower for it is enwrapped by 6 (I) and there may be yet another flower with no ovary, subtended by 6 and enwrapped by 7, 7 being sterile (J). There is usually only one bisexual flower, the lowest (K), but there may be two.

R. alba has a similar spikelet structure, but with fewer parts (fig. 5, S, T). Clarke's (1909) diagram of *R. wallichiana* and of *Eriospora pilosa* Benth., now transferred from Sclerieae to Rhynchospcreae on account of its perianth (Reynal, 1963), agree well. *Cladium* (fig. 6, F-H) has similar enwrapping glumes. Thus in both the terminal spikelet (F, G) and the lateral spikelet (H) glume 3 is wrapped round the lowest flower, which is subtended by 2. In *Schoenus* (L-N) the spikelet has up to five flowers set on a flexuous rachilla, each flower springing from the rachilla above the subtending bract rather than from the actual axil of the bract. Supraaxillary buds are common in Cyperaceae as in the rhizome of *Eleocharis* (Walters, 1950) and the culm base of *Cyperus tenuis* (fig. 4, B).

Pax (1886) described the spikelets of *Asterochaete* and *Elynanthus* as having a structure similar to that of a *Rhynchospora* or *Cladium*. But he showed the bract between the two flowers, corresponding to 6 in fig. 5 J, as a two keeled prophyll. He explained its presence by supposing the lower flower to terminate the main axis of the spikelet, and the second flower to terminate a secondary axis springing from the uppermost bract of the main axis and carrying the supposed prophyll. In *Schoenus* again he and Celakovsky (1887) supposed the spikelet to be a sympodium, each flower above the first terminating a short axis and bearing a prophyll from

which the flower above sprang. The sympodial structure separated Rhynchosporeae from other tribes.

Blaser (1941,b) showed the lower flower of *Rhynchospora macrostachya Torr.* ex A. Gray as terminal, but the disputed bract as having only one vein and no keels. Hamlin's (1955) description of the rachilla of *Schoenus* "carrying the glume above the subtended flower" was clearly based on Pax's theory. Kern (1962) again figured the spikelet of *Schoenus* as a 'rhipidium', but, since he found 'exactly the same' structure in *Cyperus*, believed that here also the spikelet was a rhipidium.

Holttum (1948) pointed out the weakness of Pax's theory. The supposed prophylls of *Asterochaete* and *Elynanthus* had no keels and were in fact glumes, though they might be compressed by the flowers between which they lay and assume angular forms (fig. 5 J, glumes 6 and 7). Again Mora (1960) has described the inflorescence unit of *Cladium* and *Schoenus* as a cymose "Scheinahrchen", identifying the more distal bracts as prophylls subtending the flowers. But his carefully drawn sections show the supposed prophylls to have the same structure as the undisputed bracts, with one keel and one vascular bundle, both median, not two of each. His drawings of a developing unit are also indecisive, for his "sterilen Spelze" appears to subtend the lowest flower and his "Vorblatt 1 and 2 the succeeding flowers of a racemose spikelet. Koyama (1961) appears justified in giving a reduced scirpoid spikelet structure for Rhynchosporeae, and the arrangement of the prophylls, not considered by him, supports this. The peculiarity of the tribe lies in the enwrapping glumes, not in a cymose structure.

Branching in Sclerieae

Scleria naumanniana Boeck. is a loosely tufted perennial, about 1.m high, of dry open bush on laterite or sandy soil (Fig. 7, A-I). The buds at the base have short conical prophylls, soon splitting as the bud bursts through the sheath of the subtending leaf (B). The florets are unisexual, set in spikelets of three kinds, male, female and bisexual (C). Young buds are mixed with the old.

Removal of the subtending bract (D) exposes a series of prophylls, inbricated one within the other (E). Branch 1 carries the prophyll 1^p and several spikelets, removed in D, and 1^p subtends branch 2, and so successively to the youngest shoot 6. As in *Rhynchospora corymbosa*, which has similar prophyll branching, a fruiting culm can survive the dry season and fruit again.

In a bisexual spikelet (F, G) glumes 1 and 2 are sterile, 3 subtends a female flower supported by a three lobed gynophore, but without perianth,

and the remaining glumes take up a subdistichous arrangement, subtending male flowers, of which most have only two stamens. The uppermost glume is small and sterile. The glumes of the male part of the spikelet are pushed aside by the female flower, the more so as the fruit expands.

The female spikelets have only three well developed glumes and the flower appears terminal. But in some spikelets there is a minute, sterile, fourth glume representing the male part of the spikelet (H, I, *m*).

Scleria verrucosa Willd., a coarse plant of permanent swamps, 1½ m, has a shortly creeping, branched rootstock, with new branches arising where the shoots turn vertically to form the culms (J). The inflorescence branches arise two at each node (K), one from the prophyll of the other, the prophylls, especially that of the minor shoot, being very delicate (L). The spikelets are unisexual, a sessile female usually springing from the prophyll of a pedicelled male spikelet (M, N). The male spikelets have numerous glumes, distichous below but spiralled above, some of the lower and the uppermost sterile, often with one or more glumes (e.g. 5) enwrapping the flowers below (O, P). The female spikelets have three to five glumes, with the flower apparently terminal (Q, R). The lobes of the gynophore enlarge and evert as the fruit ripens.

The male part of the bisexual spikelets of *Scleria* has been interpreted, by Goebel (1888), Mora (1960) and Kern (1962) among others, as a secondary branch arising from a bract of the main axis which carries a terminal female flower. Kern showed an intraspicular prophyll in the position of glume 4 (fig. 7, F, G), marking off the male part. But the dissections of Clarke (1909), Koyama (1961) and Raynal (1963) show no prophyll in this position in the many species they have studied, and Blaser's (1944, b), section of *Scleria reticularis* Michx. shows the scale in question to have a midvein but no keels. In *Hoppia* and in *Diplacrum*, a genus believed closely related to *Scleria*, the sessile male spikelets are subtended by glume-like scales below the female spikelet, but they are set off by keeled prophylls leaving no doubt as to their spicular nature. Indeed in all Sclerieae the prophyll arrangemnet is a safe guide to spicular identity.

It might be difficult, in the absence of any remnant of the male part of the spikelet, to say whether the female flower was lateral or terminal. But since in bisexual spikelets it is always lateral, it is presumably so in all species of *Scleria*, and probably in all species of Cyperaceae, even when it appears terminal. The lobes of the gynophore in this and other Sclerieae have been interpreted as perianth segments. But Blaser's (1941, b) sections show vascular bundles on their way to the ovary deviated into the lobes, not ending in them as they would if they were perianth segments.

In most Cyperaceae the region of the culm between the bud-subtending basal leaves and the bracts of the inflorescence bears no buds and is unbranched (Mora, 1960), and even if the culm is leafy as in *Fuirena* or *Rhynchospora* the culm leaves subtend no buds. But in *Scleria naumanniana* buds are found in the axils of the culm leaves, though they seldom develop unless the culm is cut. In *Scleria barteri* Boeck. the culms are profusely branched and scramble over bushes to 5m., clinging by the retrorse spicules of the stems and leaves. As in *Cyperus mundtii* this branching is clearly a secondary, not a primitive, feature of the group, as it appears to be in Cyperaceae as a whole.

Mapanieae

Mapanieae are mostly large tropical plants with wide leaves. Their basal parts resemble those of other tribes. *Hypolytrum sp.*, nr. *heterophyllum* Boeck, (fig. 8, A), growing in rich damp places in semi-shade, has wide basal leaves with spreading scaly stolons (B) breaking through their attachments. The prophylls of these stolons are short and conical, resembling those of a *Cyperus* **or** *Scleria.* But in the inflorescence the branching is peculiar. Rüter (1918), quoted by Blaser (1944), showed the prophyll in *Scirpodendron* and *Mapania* more or less divided into two separate bracts, each having a single keel and each subtending a shoot (C). In *Hypolytrum* the main branches again come off three together, the group as a whole subtended by a large bract, but each branch has its own prophll (D). The minor lateral branches carrying heads of spikelets have small tubular prophylls at the base (E). Kern (1962) has noted that, as in other Cyperaceae, the terminal head in Mapanieae has no prophyll near its base. Each bract of the head subtends a reduced spikelet enwrapped by a pair of ciliate keeled scales, united below and subtending a pair of stamens (F) with a naked female flower between (G). This is the most reduced form of spikelet found in Mapanieae, for other genera have unkeeled scales, often joined to a tube, with or without single stamens in their axils, set between the keeled pair and the female flower (H), richly developed in *Chorisandra* (I) and *Scirpodenron.*

The keeled scales appear to be derived from a single prophyll subtending two flowers, each reduced to a single stamen. They are found throughout the tribe except in *Chrysithrix*, where, as in *Eleocharis* the spikelet is solitary and terminal to the culm (Clarke, 1909), so that there could be no prophyll at its base. In general the structure is uniform and, contrary to Kern's (1962) proposal, it seems reasonable to retain the *Scirpodenron* group and the *Scirpus* group at subfamily level.

Bentham (1877) believed that the peculiar spikelet was in fact a single floret with numerous perianth segments and stamens, but Goebel (1888),

after detailed consideration, set this suggestion aside. Indeed Bentham's proposal did not explain the frequent presence of scales within the outer stamens. But in the reduced form seen in some species of *Mapania* the spikelet may resemble a single floret of a *Scirpus*, particularly *S. membranaceus* Thunb. which has a pair of keeled scales, and on such a comparison the modern synanthial theory of Holttum (1948), Koyama (1961) and Kern (1962) is based. The complex spikelet of unisexual florets of such general as *Scirpodendron* is supposed to have been reduced to a simpler type resembling that in *Mapania*, and so to the floret of a *Scirpus*. The florets became re-arranged in new spikelets of a higher order, and from Scripeae other tribes were derived.

Evidence from the prophylls, so far as they are known, does not favour the synanthial theory. The scirpoid type of single prophyll subtending only one bud, if any, opposite one of the keels can be matched in many families of monocotyledons, so it is likely to be primitive for Cyperaceae, while the divided type of prophyll subtending two buds is restricted to Mapanieae, and appears to be a specialization. Possibly *Scirpus membranaceus* should be transferred to the Mapanieae which it resembles in general habit and massive inflorescence, as well as in spikelet structure (Compare Clarke's 1909 figure with my fig. 9 F).

Reductions of the florets by loss of perianth, stamens or ovary occur in other tribes of Cyperaceae where they are always regarded as specializations, and a solitary, apparently terminal ovary is found in some species of *Scleria*. A monograph giving the general structure of Mapanieae with plans of the branching is still needed (Kunth in 1837 wrote of them "structura mihi adhuk obscura"), but the little we know favours an evolution from *Scirpus* to *Scirpodendron* (J-L) rather than the reverse.

Note on Cariceae

The Cariceae are, on the whole, an extratropical group, but are well represented on the mountains of East Africa. Fully discussed by Schultze-Motel (1959), Koyama (1961), Kern (1962) and Raynal (1963), with references to earlier work, they are unique in the placing of the solitary female flower in the axil of a utricle, a modified prophyll at the base of a spikelet, and not of a glume. How the flower reached that position is unknown, but there is no need to follow Gilley (1952) in his proposal for a new family, Kobresiaceae, for in Mapanieae also the prophyll is fertile, though it subtends two male flowers, not one female.

Hamlin (1955) says that authorities generally look to the Rhynchosporeae for the 'progenitors' of the tribe, but they may come from Sclerieae in which the flowers were already unisexual and without a perianth.

Bentham (1877) actually placed *Kobresia* in Sclerieae and *Schoenoxiphum rufum* Nees as figured by Clarke (1909), resembles *Scleria naumanniana*. The point cannot be determined on spikelet structure alone, but anatomical or embryological studies might settle the matter.

Nature of the prophyll

Blaser (1944) believed the cyperaceous prophyll to be 'merely a leaf', 'occasionally distinguishable by position and modifiable in various ways', and Koyama (1961) suggested an origin within the Cyperaceae from a 'metamorphosed bract scale' which 'would have become empty by the abortion of its axillary flower secondarily'. The 'occasionally' seems weak, for there is seldom any difficulty in making the distinction. Koyama's further statement that prophylls are homologous within genera also seems too limited, for they seem homologous throughout and even beyond, the family. Their very rare absence, as in the inflorescences of *Schoenus* (fig. 6, J) and *Chrysithrix* (fig. 7, D) is at once apparent. Nor does their presence 'differentiate rachillae from branches' for prophylls are found at the bases of both, and only at the bases of the florets are they absent.

Origin and development of Cyperaceae

Ziegenspeck (1963), Schultze-Motel (1959) and Takhtajan (1959) have summed up the evidence for the classical conception of an origin of Cyperaceae from Liliiflorae, probably through Juncaceae, evidence based on the structure of the plant, pollen and embryo, with adequate references. But Kern (1962) found a derivation 'from Liliiflorae, especially Juncaceae, impossible'. If the scirpoid type of spikelet is the most primitive in Cyperaceae it is certainly not impossible, and fig. 9 suggests how it may have happened. Wind pollination, with reduction of the flowers and their grouping in clusters are characteristics of Juncaceae. The arrangement of the bracts, prophylls, branches of different orders and lengths, and sessile terminal and stalked lateral flower clusters in *Juncus lamprocarpus*, Ehr, and the loss of prophylls within the clusters in *Luzula campestris* DC. (Buchanau, 1866) precisely parallel the inflorescence structure of typical Scirpeae. Further reduction of the perianth, association of the florets in spikelets and reduction of the ovules to one would then lead to a form of the *Scripus sylvaticus* habit. From this other Cyperaceae could have evolved, including the paniculate *Desmoschoenus*, chosen by Koyama (1958) as closest to the prototype of *Scripus*. The only form difficult to derive in this way is *Oreobolus*, where the flowers are not arranged in spikelets. Possibly this comes, by reduction of the ovules to one, from a juncaceous plant similar to *Distichea*, but with bisexual flowers. It should, in this case, be removed from the Cyperaceae.

Primitive features would then be, as Tutin (1954) stated, leafty stems, spikelets of many bisexual florets spirally arranged with few or no sterile glumes, each flower with a perianth, three stamens and three stigmas, and the ovary ripening to a trigonous nut not enclosed by a perigon or closely enfolded glume. The leafy stem is somewhat doubtful, but there may be added the presence of a prophyll at the base of all branches down to spikelet level and the absence of branching from the axils of these prophylls.

Classification could follow orthodox lines without the changes in order implied by the synanthial theory, returning to Clarke's system as modified by Marloth in the Flora of South Africa (1915), given by Koyama (1961), only substituting Rhynchosporeae for the less familiar Schoeneae:

1. Scirpeae (Primitive Cyperaceae)
2. Cypereae (From Scirpeae. Glumes distichous, perianth lost)
3. Rhynchosporae (From Scirpeae. Flowers usually few, each often enwrapped by the glume above).
4. Mapanieae (Possibly from Rhynchosporeae. Prophylls of spikelets more or less split and subtending two male flowers, usually with further monandrous male flowers below the solitary female floret, perianth lost).
5. Sclerieae, including Lagenocarpeae (From Rhynchosporeae. Flowers unisexual, the female solitary, the male above the female or in separate spikelets, perianth lost).
6. Cariceae (Possibly from Sclerieae, Prophylls of spikelets often forming utricles, subtending one female flower, with male florets above or in separate spikelets.)

Tropical Cyperaceae

Corner (1954), developing his 'durian theory', suggested that many extra-tropical plants were the dwarfed and secondarily simplified descendants of larger and more primitive types of tropical forests, where many of these forms still lived. Holttum (1948) and Kern (1962) believed that a study of tropical Cyperaceae might throw light on the origin of the family. But near Lagos and Kampala few Cyperaceae grow in dense forest, in contrast to the many specialized forest Gramineae, mostly Paniceae with broad leaves and green stilt roots. Only *Cyperus maculatus* Boeck. and C. *soyauxii* Boeck. are restricted to shade, and these are not specially remarkable species. Some larger species of *Scleria, S. racemosa* Poir. and *verrucosa* Willd. and the large *Cyperus renschii* Boeck. and

fischerianus Schimp. ex Hochst. grow in forest, but along streamsides where there is some break in the canopy, and they also grow vigorously where it is damp but there are few trees. *Fuirena* is tolerant of light shade, but grows better in the open and only on ground which is damp for at least part of the year. *Scleria naumanniana* is a plant of dry bush, but only where the bush is open, usually from human interference. Even the climbing *Scleria barteri* is confined to low secondary bush and is not found in tall forest.

In fact most of our Cyperaceae are plants of open damp places, particularly shallow swamps rather than of shady or dry situations. Their abundance depends on destruction of forest or unsuitability of the habitat for forest growth, and they have undoubtedly been spread by human habitation, cultivation and burning. Many are found in the precincts of towns. Some Mapanieae do grow in damp forest conditions, but their morphology appears peculiar and they seem to represent an end product of evolutionary specialization. Cyperaceae appear to have invaded the forest from more open situations rather than the reverse.

Even if the essentials of the durian theory were accepted this would not imply the primitiveness of tropical forms. For, as Corner (1954) pointed out, Juncaceae are mainly 'leptocaul and extra-tropical', though possibly derived from a pachycaul such as *Prionia.* (There are no Juncaceae in the forests and savannahs of Nigeria proper or lowland Uganda, but they grow on the highlands of East Africa and the Cameroons.) If then Cyperaceae are derived from Juncaceae the transition probably occurred outside the rain-forest.

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INDEX TO SPECIES

(Received for publication 28th March, 1966)

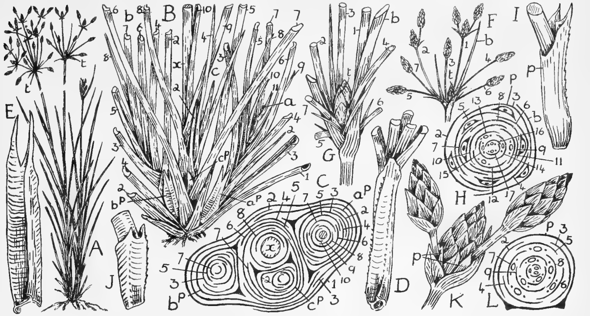

Fig. 1. *Fimbristylis:*
A — *F. dichotoma*, habit. B — *F. obtusifolia* portion of base. C. — plan of B. D — young tubular prophyll. E — old, split prophyll. F — *F. dichotoma*, inflorescence. G — central part of F. H — plan of F. I — prophyll of larger branch. J — prophyll of smaller branch. K — cluster of spikelets. L — plan of lateral spikelet.

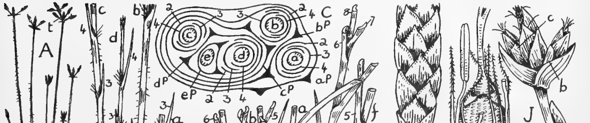

Fig. 2 *Fimbristylis, Eleocharis, Scirpus:*
A — *F. hispidula*, habit. B — portion of base. C — plan of B. D — prophyll from base. E — prophyll from inflorescence. F — *F. dichotoma*, portion of base. G — plan of F. H — *E. mutata*, base of *spikelet*. I — flower J. — *S. brachyceras*, cluster of spikelets.

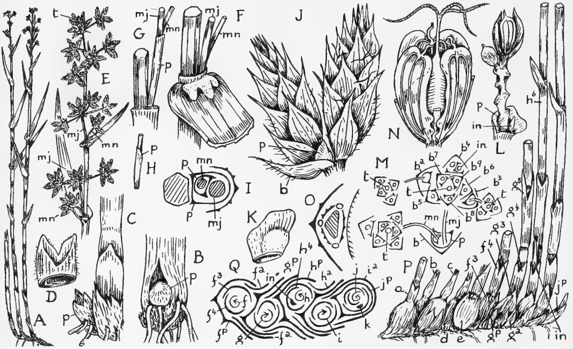

Fig. 3. *Fuirena umbellata:*
A — habit. B and C — base of culm. D — prophyll from base. E — inflorescence. F — branches from culm. G and H — bases of branches. I — plan of F. J — pair of spikelets. K — prophyll from base of spikelet. L — rachilla of fruiting spikelet M — plan of portion of inflorescence. N — flower. O — plan of flower. P — bulbous from. Q — plan of P.

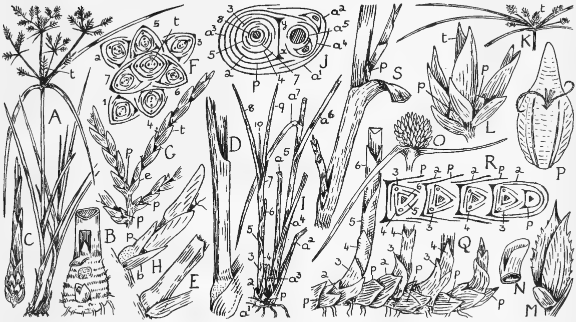

Fig. 4. CYPEREAE: *Cyperus*, *Kyllinga*, *Ascolepis*.
A — C. *tenuis*, habit. B — base of culm. C — young shoot. D and E — bases of inflorescence branches. F — plan of inflorescence fragment. G — spikelets. H — base of spikelet. I C. *subumbellatus*, fragment of base. J — plan of I. K — inflorescence. L — spikelets. M — K. *pumila*, spikelet. N — prophyll from spikelet base. O — A. *capensis*, inflorescence. P — disseminule. Q — K. *erecta*, stolon. R — plan of Q. S — C. *mundtii*, fragment of stem.

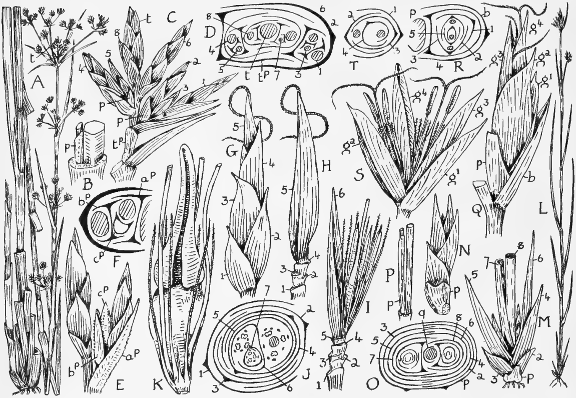

Fig. 5. *Rhynchospora:*
A — *R. corymbosa*, habit. B — inflorescence branch. C — group of spikelets. D — plan of C. E — prophyll branching. F — plan of E. G — spikelet. H — spikelet, four glumes removed. I — spikelet, flower exposed. J — plan of G. K — ripe fruit. L — *R. alba*, habit. M — base of plant. N — young shoot. O— plan of M. P — inflorescence branch. Q — spikelet. R — plan of Q. S — terminal spikelet spread. T — plan of S.

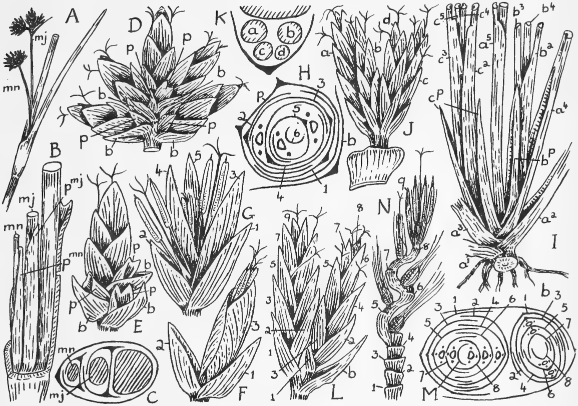

Fig. 6. RHYNCHOSPOREAE: *Cladium*, *Schoenus*.
A — *C. mariscus*, inflorescence fragment. B — branch bases. C — plan of B. D — cluster of spikelets. E — terminal spikelet and bases of three others. F — Third, enwrapping glume. G — spikelet spread. H — plan of G. I — *S. nigricans*, base of plant. J — group of spikelets. K — plan of J. L — two spikelets. M — plan of L. N — rachilla and florets.

Fig. 7. *Scleria:*
A — *S. naumanniana*, habit. B — bases of culms. C — cluster of spikelets. D — prophyll branching. E — plan of D. F — bisexual spikelet, spread. G — plan of F. H — female spikelet, fruit fallen. I — plan of H. J — *S. verrucosa*, base of culm. K — inflorescence branching. L — prophyll from K. M — fragment of inflorescence. N — plan of spikelet group. O — male spikelet, spread to fifth glume. P — plan of O. Q — female flower.

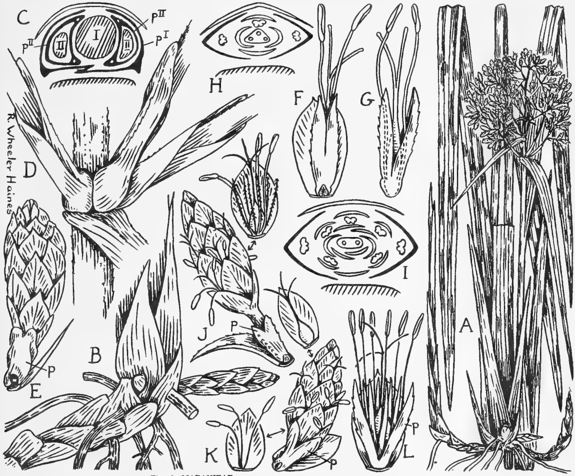

Fig. 8. MAPANIEAE:
A — *Hypolytrum heterophyllum*, habit. B — base of plant. C. — *Mapania*, inflorescence branches, after Rüter (1918) and Blaser (1944). D — *Hypolytrum*, inflorescence branches. E —→ Head with prophyll. F — Bract with spikelet. G — spikelet, dorsal view. H — *Thoracostachyum* after Clarke (1909). I — *Chorisandra* after Clarke (1909). J — scirpoid bract and spikelet. K — reduced spikelet with unisexual flowers. L — Mapanoid spikelet.

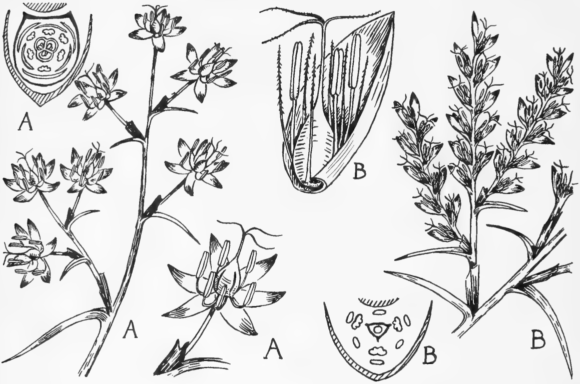

Fig. 9. Origin of Cyperaceae, orthodox theory:
A — Liliiflorous plant, with single flower and plan. B — primitive scirpoid plant with flower and plan.

BOOK REVIEWS

FLORA ZAMBESIACA

This flora, produced by a distinguished team of British, Portuguese and Rhodesian botanists deals with the seed plants of Malawi, Zambia, Botswana, Rhodesia and Portuguese East Africa. Although the first part appeared in 1960 the existence, excellence and usefulness in East Africa of the work seem much too little known to naturalists in this part of the world. The four parts which have so far appeared cover the Gymnosperms and all Dicotyledonous families before the Leguminosae in the sequence of Bentham and Hooker. Every taxon is fully described, almost every genus is illustrated in black and white and there is a fine coloured plate at the beginning of each part. The key to families in vol. 1, part 1, provides the best available method by which an unknown indigenous East African plant can be assigned to its family. While Flora Zambesiaca will clearly be more useful to naturalists in southern Tanzania than to those further north, as long as 'The Flora of Tropical East Africa' is incomplete it is a 'must' for every botanist in East Africa and, on account, especially, of the plates, it will remain useful even when F.T.E.A. is complete.

Particulars of the parts which have so far appeared are as follows.

Vol. 1, part 1 (1960) up to Polygalaceae, 336 p., 59 pl., 25/-.

Vol. 1, part 2, (1961) Caryophyllaceae-Sterculiaceae, 245 p., 49 pl., 25/-

Vol. 2, part 1 (1963) Tiliaceae—Icacinaceae, 351 p., 75 pl., 30/-

Vol. 2, part 2 (1966) Aquifoliaceae—Connaraceae, 300 p., 62 pl., 30/-

All parts are obtainable from the Govt. Bookshop, P.O. Box 569, London S.E.1. and Samcax Book Services Ltd., P.O. Box 2720, Nairobi.

J.B.G.

GRASSES OF TANGANYIKA

by

D. M. Napper, and other works on E. African grasses.

The appearance in January, 1966 of Miss Napper's splendid little book, whose title should have been 'Grasses of Tanzania' since Zanzibar and Pemba are included, means that we now have excellent manuals for the identification of grasses in each of the three East African countries. All the 700 grass species, included in 172 genera, which are known to occur in Tanzania, are keyed out, readily visible characters being used, in order to help the field worker, wherever possible. A brief descriptive

note and a summary of the known distribution are supplied for each species, and the fact that specimens are cited will be a great help to the herbarium taxonomist. The essential features of 219 species, including the typical forms of genera and difficult or unusual species, are illustrated in 20 full page composite plates. A map, short glossary and full index complete the work. The Government Printer Dar es Salaam and his staff are to be congratulated on the high standard of printing. Only two errors have been detected. That on p. 127, where the caption for fig. 188 has been misapplied to fig. 187, whose true caption should be *Digitaria diagonalis*, spikelets x 8, is important.

Particulars of the companion works, for Kenya and Uganda as well as those of 'The grasses of Tanganyika' are given below. It should be noted that the 123 full page plates, illustrating over 420 species which appear in the Uganda book form a most valuable supplement to the works for Kenya and Tanzania.

A. V. Bogdan 'A revised list of Kenya Grasses, with keys' (1958) obtainable from Govt. Printers, P.O. Box 30128, Nairobi, 5/-, postage 30 cents.

K. W. Harker & D. M. Napper 'An Illustrated Guide to the Grasses of Uganda' (1961). Obtainable from Govt. Printer, P.O. Box 33, Entebbe 22/50, postage 65 cents; or leading Nairobi bookshops.

D. M. Napper 'Grasses of Tanganyika' (1965). Obtainable from Govt. Printer, P.O. Box 9124, Dar es Salaam, 21/- postage 1/25; or leading Nairobi bookshops.

J.B.G.

BOOKS ON THE FERNS OF TROPICAL AFRICA

For many years naturalists in East Africa have felt the need for books, especially illustrated books, which would help them to identify ferns. Until recently almost the only work available was T. R. Sim 'The Ferns of South Africa' Cambridge U.P., 2nd Edn. 1915. This illustrates 288 species in 181 plates and is still of great value, but the representation of tropical species is inadequate, the nomenclature is much out of date and the book can be obtained, through second hand booksellers, only occasionally and with difficulty.

For a really satisfactory account of East African ferns we must await the appearance of the relevant part of 'The Flora of Tropical East Africa' which is now being prepared by Dr. F. M. Jarrett at Kew. Those who

now collect ferns in East Africa, especially if they are able to visit the less well known areas such as the Eastern slopes of Mt. Kenya, the Nyambeni range, the Nguru and Uluguru mountains in Tanzania, south eastern Tanzania in general and the more inaccessible mountains of Uganda, have the opportunity to contribute to Dr. Jarrett's work.

For their guidance several recent works dealing with the ferns of West Tropical Africa which have received little or no attention in East Africa will be found of great value.

In 1953 appeared 'Les Ptéridophytes de l'Afrique intertropicale Francaise' (Memoire 28 of I.F.A.N.) by Mme M. L. Tardieu-Blot, in which 256 species in 66 genera are described; 205 of these are illustrated in 44 plates. This work is completed in the first section of Memoire 50 of I.F.A.N. (1957) in which 46 species in 7 genera of fern allies are described, 24 of them illustrated in 8 plates.

'The Ferns and Fern Allies of West Tropical Africa' (1959) by A. H. G. Alston keys out 305 species in 72 genera: 15 species are illustrated in 11 plates.

Lastly in 1964 appeared Vol. 3 'Ptéridophytes' of the 'Flore du Cameroun' in which Mme. Tardieu-Blot describes 256 species in 69 genera, 181 species being illustrated in 55 plates. Naturally this repeats to a large extent the author's earlier work, in fact 13 of the plates are identical, but the treatment of many of the species has been considerably improved.

In order to assist those who may wish to obtain these works the addresses from which they may be obtained with current prices are given below. Postage is in each case extra.

M. L. Tardieu-Blot 'Les Pteridophytes de l'Afrique intertropicale Francaise'
I Memoire de I.F.A.N. 28. 16 N.F. (c. 25/-)
2 Mem. de I.F.A.N. 50. 20 N.F. (c. 30/-)

Librairie Clairafrique, 2 Rue Sandiniery, B.P. 2005, Dakar, Senegal.

H. G. Alston 'The Ferns and Fern Allies of West Tropical Africa' The Govt. Bookshop, P.O. Box 569, London S.E. 1. 7/50.

M. L. Tardieu-Blot 'Flore du Cameroun, 3, Pteridophytes' Mus. Nat. D'His. Naturelle, Lab. de Phanerogamie, 16 Rue Buffon, Paris 5c. 57 N.F. (c. 85/50).

J.B.G.

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JOURNAL

OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. XXVI No. 2 (114) JANUARY 1967

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(Published 20/11/67)

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Nomenclature. Where a recent standard work for the area is available (e.g. Praed and Grant for birds) the names given there (both English and scientific) should be used. Initial capitals should be used for specific English names, e.g. Pied Wagtail and small intitial letters for group names, e.g. wagtails. Scientific names must always be underlined and followed by the naming authority when mentioned for the first time. Where an English name is used, it must, on first mention be accompanied by the scientific name.

References. These are usually abbreviated in the text and listed more fully in alphabetical order of authors at the end of the article. For example, in the text book reference might be (Pinhey 1956: p. 20). At the bottom of the contribution: Jackson, F. J., 1938. *Birds of Kenya and Uganda.* Pinhey, E. C. G., 1956. *The Emperor Moths of Eastern Africa.* J.E. Afr. Nat. Hist. Soc. XXIII No. 1, (98). With short articles it may not be worth making a list of references at the end, but the whole reference in the most abbreviated comprehensible form should then be inserted in the text.

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A JUNE-JULY CENSUS OF SMALL MAMMALS ON THE ATHI PLAINS, KENYA

By

D. S. Hartman

(*Conservation Department, Cornell University, Ithaca, New York*)

INTRODUCTION

Ecological studies of small mammals in East Africa are scarce. What little intensive work that has been undertaken centres on observations of habitat distribution and breeding cycles. Southern and Hook collected data on the distribution of Soricids and Murids in Uganda high forest (1963a) and later studied the reproductive condition of some insectivores and rodents of Uganda and Kenya (1963b). Delany (1964) summarized all quantitative work on small mammals in Africa south of the Sahara and added his own results from trappings in Uganda. The following superficial observations, the first on the Athi Plains, are presented merely as a guidepost for further investigations.

Briefly, the study area falls within the semi-arid "scattered tree" or *Acacia-Themeda* grassland biome (Edwards & Bogdan, 1951). The area is characterized by an abundance of red oat grass, *Themeda triandra* Forsk., whose dominance is ensured by periodic fires and impeded soil drainage, both of which factors retard the advance of tree and bush constituents (*Ibid*). Where conditions are favourable, stunted whistling thorn, *Acacia drepanolobium* Harms ex Sjöstedt, is found in association with *Themeda*. On the plains trees and shrubs are otherwise found only in riparian depressions. (For a fuller description of floral constituents see Heriz-Smith, 1962.)

Mean annual rainfall on the plains varies between 20 and 30 inches. Years with less than 20 inches are not uncommon. Drought is a feature of the habitat. Rain, when present, is characteristically sporadic, localized, torrential, and short-lived. Run-off is rapid; evapo-transpiration loss, high.

Possibly more imoprtant with regard to the ecologic distribution of small mammals is the prevalence of a heavy black clay—the infamous "black cotton" soil of East Africa. This clay becomes glutenous and waterlogged during the rains, concretionary and impenetrable during drought, subjecting the homogeneous surface horizon to its annual kneading and mixing and perhaps making conditions for burrowing and life in the subsoil intolerable for shrews and rodents.

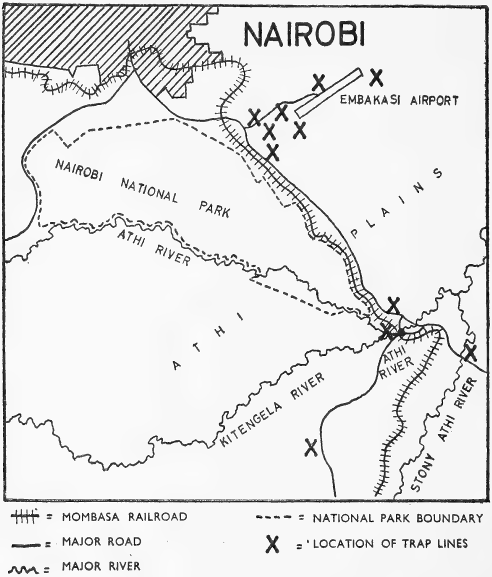
The purpose of the sampling programme was primarily to determine the species composition and relative numbers of the small mammals of the plains habitat. The two months devoted to the study coincided with the onset of the long dry season during which period the vegetation was either overgrazed, mowed, burned, or simply drying up—in all cases depleting food and cover sources. It was hoped a significant correlation between environmental pressures and population density would be evident. Secondarily, ancillary observations were to be made on reproductive condition, niche diversity, and habitat preference.

METHODS AND MATERIALS

The species composition and relative density of small mammals were obtained by line-trapping. A slight modification of the NACSM B-type line (Calhoun, 1951) was adopted.

Two parallel lines, 60 snap traps to a line, were set over 400 yards apart but in the same vegetative faciation. Each line was divided at 50 ft. intervals into 20 stations. At every station two standard $7 \times 3''$ rat traps and one $4 \times 2''$ mouse trap were set within two yards of the centre of the station in spots most likely to capture animals. Various baits were separately experimented with, including cheese, raisins, and aniseed oil, none of which yielded any greater trapping success than the ultimately chosen mixture of peanut butter and rolled oats. Traps remained set for three consecutive days after which the transects were relocated in a new area. The distribution of trapping locations is presented in Figure 1. Typically, two locations were sampled in a week. Vegetative faciations sampled included: riverine forest (6 days); overgrazed, mown or burned grassland and bush (9 days); and undisturbed *Acacia-Themeda* (21 days).

FIGURE 1. Distribution of trapping locations on the Athi Plains.



Trapping was conducted from May 30th through July 28th, 1966. While operative, the trap lines were checked daily at 6:30 a.m. and 6:30 p.m. Collected animals were subjected to routine necropsy procedures in the laboratory with especial emphasis on reproductive condition. Study skins were sent to the Cornell University Museum.

RESULTS

In the course of 4,320 trap-nights a total of only 12 mammals of but two species was collected (Table 1). All captures were made at night. The categorization of the faciations in which the trap line pairs were set is not included as trapping success showed no bias toward a particular vegetative type. The results are therefore lumped under the plains habitat as a whole.

TABLE 1

SPECIES NUMBERS, COMPOSITION, AGE AND SEX DISTRIBUTION, AND REPRODUCTIVE CONDITION

No.	Species	Age	Sex	Reprod. Cond.	Date
	Insectivora:				
1	*Crocidura fumosa* Thomas	A	F	breeding	28–6–66
2	,, ,,	A	M	non-breeding	7–7–66
3	,, ,,	A	M	non-breeding	8–7–66
4	,, ,,	A	F	breeding	12–7–66
5	,, ,,	A	F	breeding	28–7–66
6	,, ,,	A	F	breeding	28–7–66
	Rodentia:				
1	*Mastomys coucha* A. Smith	J	M	non-breeding	8–7–66
2	,, ,,	A	M	breeding	12–7–66
3	,, ,,	A	M	breeding	12–7–66
4	,, ,,	A	M	breeding	14–7–66
5	,, ,,	A	F	breeding	14–7–66
6	,, ,,	J	M	non-breeding	14–7–66

In addition, mole-rats, *Tachyoryctes splendens* (Rueppel), were observed tunneling on several occasions, usually in the loosened black soil around aardvark diggings.

Though only a single animal was captured in the month of June as opposed to the remaining 11 in July, signs of presence (faeces, runways, middens, and cuttings) were much in evidence in early June but rare by late July. Correspondingly, insects, seeds, and green shoots were abundant at the beginning of the study and showed a progressive decline into the dry season.

DISCUSSION

Any inference from such scant results must be made with care. The fact that 80% of the adults captured (100% of the females) were reproductively viable stands in opposition to the assumption that a breeding peak should coincide with the end of the rains when environmental pressure would be minimal, when the replacement of vegetation would provide optimal conditions of cover and food. Approaching the end of the sampling period, reproducing individuals showed no trend toward declining reproductive stages. Otherwise, the numbers trapped are simply too small either to statistically analyze or to gauge cause and effect factors.

Small mammal populations have been shown to be cyclic, to fluctuate regularly in numbers, where unstable environmental circumstances prevail, notably on the arctic tundra. The reason or reasons for their predictable fluctuations are still a matter of dispute. It is doubtful that the populations of the Athi Plains cycle as such but probable that they fluctuate irregularly dependent upon climatic and affiliated changes. From personal inquiries I gather that there have been eruptions of small mammals on the study area. No one can recall, however, the duration of these periods or the seasons in which they occurred. The two month sample provides little insight into the question other than a presumed ebb in numbers if indeed a fluctuation is present.

Equally undiscovered are the adaptations the animals have evolved to tide them through the annual droughts on the grasslands. The results give no indication of mass death, aestivation or emigration to more favourable areas (water catchment basins, for example). The data gives only an index of the density and reproductive status of small mammals over a two month interval and professes to be no more than a framework for a future study which would demand at least four years.

SUMMARY

Coinciding with the advent of the "long dry season" in Kenya, a two month sampling of the small mammal population of the Athi Plains was carried out determining (1) the species composition and numbers and (2) the reproductive status of the animals collected. The results of over 4,300 trap nights indicated a dearth of small mammals, yielding only 12 individuals of two species, 8 of which were in breeding condition. Environmental factors influencing the paucity of animals are discussed. The possibility of a fluctuation in numbers is inferred.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. J. B. Foster of the Dept. of Zoology, University College, for his suggestions and criticisms, Alexander Duff-Mackay of the National Museum for his help in identification of the specimens, and Miss Jean Angwin also of the Dept. of Zoology for her assistance in the preparation of study skins.

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(*Received on* 3*rd November*, 1966)

SOME GASTEROMYCETES FROM EASTERN AFRICA

By

D. M. DRING and R. W. RAYNER

INTRODUCTION

During recent months a number of collectors have sent gatherings of gasteromycete fungi from E. Africa to the Kew Herbarium. This paper has been written to record the results of their collecting as well as to give them, and other workers in the area, an admittedly incomplete but, it is hoped, useful guide to the puffballs and their allies in the East African region. Recently collected material has been supplemented by studies of the older collections in Kew (K) and elsewhere, particularly the E. African Herbarium (EA).

Though this study is centred on E. Africa in a restricted sense we have also included some material from Malawi, Zambia, Rhodesia and Mozambique where considered appropriate. In a like manner Somalia has also been included. Perhaps, however, it is more important to note that we have also included the rather few gasteromycetes which we have examined from the Mascarene Islands. Though their nearest mainland is the east coast of Africa, these islands are known to have strong floristic affinities with Asia and Australasia rather than with Africa. So that, unless there is evidence to the contrary it should not be assumed that species recorded from these islands will occur on the African mainland.

The colour names used, excepting those describing microscopic characters, are based on Dade, Colour Terminology in Biology ed. II, *Mycol. Pap.* 6, 1949.

COLLECTING

Gasteromycetes are easy to collect and preserve. All except Clathraceae and Phallaceae should simply be dried quickly and placed in boxes or packets with the usual data on place of collection, date, etc. They should never be pressed. If the collector has the time, inclination and very modest skill required, he should make pencil sketches, or better, water-colour paintings of the fresh material. In the case of phalloids, though dried material is better than none, the best method of preservation is to put at least part of each collection into bottles of spirit, once again making adequate collector's notes and if possible a painting or other indication of the colour of the fresh material.

GLOSSARY OF TERMS USED

ADAXIAL	towards the axis
ALVEOLUS	small depression or hollow in a surface
AMYGDALIFORM	almond shaped
APICULUS	short projection
APOPHYSIS	swelling at the base of the spore-sac
BALLISTOSPORE	spore which is violently propelled from its mother-cell
BASIDIUM	the spore-mother-cell of badidiomycetes, bearing spores on short spines or sterigmata
CADUCOUS	falling away early
CAESPITOSE	growing from a single point
CAMPANULATE	bell-shaped
CAPILLITIUM	mass of sterile, thread-like hyphae mixed with the spores (cf. paracapillitium)
CLAMP-CONNEXION	characteristic protuberance at the septum in certain hyphae of some basidiomycetes
CLATHRATE	in the form of a lattice
CLATHROID (n)	a member of the Clathraceae
COLLAR	of a phalloid, the pad of tissue at the apex of the cap surrounding the apical perforation, if any; of *Tulostoma*, that part of the outer peridium which adheres to the head and surrounds the socket
COLUMELLA	a sterile prolongation of the stipe into the gleba (cf. pseudo-columella)
CORTEX	of the peridiole of Nidulariaceae, the dark-coloured layer
CRENULATE	of sterile bases, longitudinally wrinkled

DIAPHRAGM	of Lycoperdaceae, a membrane separating gleba from subgleba and confluent with the endoperidium
ECHINATE	spiny
EGG	of phalloids, the immature fruit-body and its enclosing universal veil
ENDOPERIDIUM	the inner layer of the peridium in Lycoperdales
EVANESCENT	fleeting
EXOPERIDIUM	the outer layer of the peridium in Lycoperdales
FARINA	floury coating
FLOCCOSE, FLOCCULENT	cottony
FUNICULUS	of Nidulariaceae, an elastic cord joining the peridiole to the cup wall
FUSIFORM	spindle-shaped
GLEBA	spore-mass
GLEBIFEROUS	bearing the gleba
HYMENIUM	fertile layer; in basidiomycetes it is composed of basidia
IMBRICATE	overlapping like tiles on a roof
INDUSIUM	of "Dictyophora", the net-like organ hanging from near the stipe apex, under the cap
MAMMOSE	breast-like
MULTISERIATE	of the stipe wall of a phalloid, consisting of more than two layers of chambers
NAKED	of a stoma, without a differentiated peristome
OSTIOLE	stoma, mouth
PARACAPILLITIUM	hyphae resembling those of the true capillitium except that they are hyaline, collapsed, and with frequent septa
PERCURRENT	of a columella, extending right through the gleba
PERIDIAL SUTURE	of clathroids, membrane joining the universal veil (outer peridium) to the receptacle
PERIDIOLE	discrete portion of the gleba, surrounded by its own wall
PERIDIUM	wall or membrane enclosing the fertile part of the fruit-body
PERISTOME	area surrounding the stoma
PHALLOID (n)	a member of the Phallaceae or of the Phallales, according to context
PILEUS	cap of the agaricoid forms
PLACENTA	of Sclerodermatales, tissue which nourishes the spore after its discharge from the badidium
PSEUDOCOLUMELLA	a $\pm$ densely woven, central mass of capillitium
PSEUDOSTEM	stem-like structure with tissues not orientated along the long axis of the fruit-body, usually consisting of $\pm$ spongy tissue
PUNCTATE	having minute warts or depressions
PYRIFORM	pear-shaped
RECEPTACLE	the spongy part of a phalloid
RETICULATE	in the form of a net
REVOLUTE	backwardly curved
RIMOSE	abundantly cracked, "crazed"
RUGULOSE	finely wrinkled
SACCATE	shaped like an open bag
SCABROUS	rough and peeling
SECOTIOID	pertaining to *S cotium* and the Secotiaceae
SESSILE	lacking a stalk

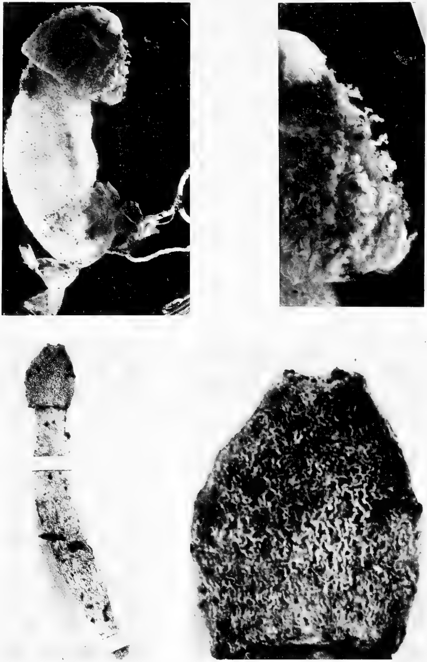

Plate 1

A. ***Phallus caliendricus***, spirit material, habit, c. × 1 (Type); B. *P. caliendricus* cap ornament c. × 2 (Type); C. *P. caliendricus*, dried material, cap c. × 4 (BALLY); D. *P. caliendricus*, dried material, habit, c. × 1 (BALLY).

STERILE BASE	the pseudostem in Lycoperdaceae
STOMA	of a puffball, the apical pore through which the spores are discharged
STRIATE	etched with fine lines
STROMA	compact mass of vegetative hyphae bearing fruit bodies (cf. subiculum)
SUB-BISERIATE	of the stipe wall of a phalloid, consisting mainly of a double layer of chambers
SUBICULUM	a sheet of mycelium covering the substrate and bearing the fruit bodies (cf. stroma)
SULCATE	grooved
TOMENTUM	covering of soft hairs
TRAMAL PLATE	structure supporting the hymenium
TRUNCATE	cut-off short
TUNICA	of the peridiole of Nidulariaceae, the outermost hyaline layer
UNISERIATE	of the stipe-wall of a phalloid, consisting of a single layer of chambers
URCEOLATE	urn-shaped
VOLVA	the cup-like basal remains of the universal veil after expansion of the fruit-body

THE GASTEROMYCETES

In a popular sense the term gasteromycete implies a basidiomycete in which the spore-mass or *gleba* is enclosed in a sac-like *peridium*. The familiar puff-ball is a typical example. Unfortunately, this conception does not cover the wide range of forms which are conveniently classified as gasteromycetes.

Technically, gasteromycetes are those higher basidiomycetes whose hymenia are enclosed, at least at an early stage of development, and whose basidiospores are not shot-off from the basidium. Thus, some forms very like agarics and boleti are included in the definition of gasteromycete simply because they do not discharge their spores violently from the basidium.

Inability to produce ballistospores has resulted in other means of discharging spores. Ingold (1953) has described the gasteromycetes as "an assorted collection of experiments in spore discharge," and indeed they are. There is, however, at least one other factor which seems to have contributed to this diversity. Since the violent discharge of the ballistospore depends on the hydrostatic pressure within the basidium, the hymenium must be turgid throughout the period of spore-discharge. Gasteromycetes do not have this limitation and are therefore better adapted to fruit in dry conditions than other basidiomycetes. Once again, this has resulted in diversification of both habitat and habit.

In addition to the puffballs and agaricoid forms referred to above there are many other groups. In the birds' nest fungi (Nidulariaceae) the gleba consists of pellets (*peridioles*) which are dispersed from the cup-shaped peridium by raindrops. In several groups the differing water-absorbing capacity of the various layers of the peridium is used as an aid to discharge. In the earth-stars (*Geastrum*) the outer peridium splits into rays which in some species bend backwards on drying, elevating the spore sac to a height more advantageous for spore-discharge. In other species of *Geastrum*, and in the similar *Astraeus*, the rays enclose the spore sac when dry, opening and permitting spore discharge when moist conditions prevail. In *Mycenastrum* the inner peridium behaves in the opposite way, cracking into lobes, bending back and exposing the powdery gleba when dry; closing when wet.

In the Clathraceae and Phallaceae ("stinkhorns"), the foetid gleba is exposed to the attentions of flies, often on a flower-like receptacle. In the Hymenogastraceae and similar hypogeal fungi ("false truffles") the peridium is ruptured and the spores dispersed by burrowing animals. A glance through the illustrations to this paper will give some guide to the range of fungi which go to make up the gasteromycetes.

Key to the families discussed

Gleba becoming powdery (occasionally granular) at maturity 1
Gleba becoming mucilaginous at maturity 3
Gleba neither powdery nor mucilaginous 4

1. Capillitium of $\pm$ thread-like hyphae not present in gleba . . *Sclerodermataceae*, p. 18
   Capillitium abundant 2
2. Fruit-body sessile or with a sterile base of $\pm$ spongy tissue not orientated along the long axis of the fruit-body . . . . *Lycoperdaceae*, p. 22
   Fruit-body with a true stipe of hard, orientated tissue. Columella absent *Tulostomataceae*, p. 42
   Fruit-body with a true, woody stipe prolonged into the gleba as a percurrent columella *Podaxaceae*, p. 11
3. Gleba usually borne on the inside of the receptacle, which may be sessile or stipitate and consist of a globose network or of several columns united at the top, or of spreading arms . . . . *Clathraceae*, p. 15
   Receptacle a single, unbranched column supporting gleba near its apex . . *Phallaceae*, p. 11
4. Hymenium borne on $\pm$ gill-like plates. Fruit-body usually stipitate . *Secotiaceae*, p. 10
   Hymenium absent, gleba organized into seed-like peridioles. Fruit-body usually cup-shaped, less than c. 1 cm. diam. . . . . *Nidulariaceae*, p. 20

SECOTIACEAE

The members of the Secotiaceae are easily recognizable by their gross resemblance to agarics. They have a stipe and an apical pileus which at maturity may spread out like that of a mushroom (e.g. in *Montagnea*) or remain almost closed (e.g. *Galeropsis*). The gleba consists of a true hymenium lining persistent tramal plates. These latter are often radially arranged in the same way as the gills of an agaric (*Montagnea*), or more or less anastomosed but retaining some visible radial orientation (*Galeropsis*), or so anastomosed that their basic orientation is obscured. The spores of the entire group are brown, double-walled, with an apiculus and usually a germ-pore. In the more agaricoid genera they tend to have the same symmetry as a ballistospore; in the more secotioid genera the spores tend to be irregular or globose.

They are typically fungi of arid regions. Only two genera are known to us from E. Africa.

Montagnea Fr. (=Montagnites Fr.)

This genus consists of *Coprinus*-like plants with radial, non-branched gills and an expanded pileus. It is usually defined as having the apex of the stipe expanded into a small disc, from the margin of which hang the gills. Much material, especially when gathered in an over-ripe condition does appear to fulfil this definition. However, material in good condition clearly shows that the pileus covers the whole of the abaxial edge of the gills but is very thin and splits between them. In older specimens the gills become twisted and the thin backing of pileal tissue may be obscured, the gills appearing to be attached only where they abut onto the disc.

Complete specimens have a well-developed volva. The stipe is hollow in all known *Montagnea* species, and this character, together with the non-branched gills, clearly separates them from the allied genus *Gyrophyragmium* Mont.

There is but a single well known species, *M. arenaria* (DC.) Zeller (=*Montagnites candollei Fr.*). One of us (R.W.R.) has collected it in the Rift Valley, nr. Suswa volcano and we are informed by Dr. N. Otieno of its occurrence north of Isiolo, Kenya. The sketch (Fig. 1d) is based on a photograph of Otieno's material.

Galeropsis Velen.

Pileus not expanding at maturity but remaining as a subglobose, subovoid or subconic structure, narrowly open at the base. Gills radial but somewhat anastomosed. Stipe well developed, slender, hollow, without volva at base but often with a well-developed, sometimes marginate bulb.

Southern Africa seems to be particularly rich in species of this genus. Two have been recorded for S. Africa: *G. mitraeformis* (Berk.) Heim, and *G. liberatus* (Kalch.) Heim, both of them from the extreme south, another, *G. besseyi* (Pk.) Heim var. *madagascariensis* (Pat.) Heim from several localities in Madagascar. Finally *G. paradoxa* (Matt.) Heim has been recorded from Ethiopia. Heim (1950) expresses the tentative view that all are forms of a single variable species (and cf. the situation in *Podaxis*). Indeed distinctions between the species seem difficult to define. For the moment, however, we shall accept the generally held view that separate taxa are involved.

G. aff. *paradoxa* (Matt.) Heim. (Fig. 1f-h)

Pileus clavate-conic, to about 2×1 cm. pale tan. Gills adnate, frequently anastomosed; basidia 4-spored, waisted, about $25 \times 5\mu$, spores amygdaliform, $10\text{–}13 \times 6\text{–}7.5\mu$, pale amber, with small but clearly visible germ-pore. Stipe to 8 cm. long with a well-developed basal bulb.
HABITAT: On the ground in pasture at 2–3000 m. alt.
MATERIAL EXAMINED: KENYA: J. K. DEDAN 1233, Forest Dept., Kikuyu, in grass, April, 1965 (K); nr. Limuru, in Kikuyu grass pastures, abundant (R.W.R's notes).
NOTES: The material which we have seen, fresh, dried and preserved in spirit, corresponds with that described by Mattirolo (1924) in habit, habitat (including altitude) and in spore size (the last as given by Heim (1950) for Mattirolo's material) but the gills are apparently thinner and rather less frequently anastomosed, and the basidia are apparently all tetrasporous whereas Mattirolo noted both 2- and 4-spored basidia.

The gills are adnate (Fig. 1g), that is to say that if the pileus were to be opened out like that of an agaric the proximal edges of the gills would be confluent with the tissue of the stipe. This is clearly seen in the spirit material and confirmed in transverse sections of the upper 1/3 of the cap. Contrary to the impression to be gained from study of the literature, adnate insertion seems to be usual in this genus. Kotlaba (personal communication) confirms that it is true for *Galeropsis desertorum* Velen. The gills appear to be free in dried material of all species of the genus.

Sectioning of the gills shows them to be of the inaequihymeniiferous type (Buller, 1922) with basidia maturing in succession. The basidium elongates considerably just before maturity, and develops four slightly curved sterigmata on which the spores are borne. The result is that just as in an agaric the spores are held clear of the hymenial surface until they become ripe. In an agaric they would then be forcibly cast off from the sterigmata and the basidium would then collapse. In this case, however, they are not discharged but remain attached to the sterigma whilst the basidium collapses and draws them down again on to the hymenium to which they firmly adhere. As a result of the repetition of this process with the successively maturing basidia the hymenium becomes covered with a thick layer of spores. Basidia can be seen *in situ* only in very thin sections.

The cuticle of the pileus is of ordinary hyphae, not cellular as in the Bolbitiaceae, the family of agarics to which this genus is obviously closely related (Singer, 1962).

PODAXACEAE

This family shares all the characters of the Secotiaceae, except that the tramal plates break down before maturity and are replaced by capillitium. Thus the gleba is pulverulent as in Lycoperdaceae but the spores resemble secotioid spores.

There is a single genus, *Podaxis* Desv. Morse's (1933) contention that all the forms are referable to a single variable species has not yet been refuted.

Podaxis pistillaris (L. ex Pers.) Fr. sensu Morse (Fig. 1a-c)

Sporocarp to 20 cm. high, consisting of an ellipsoid to subcylindric or subconic head supported on a slender stipe. Peridium dirty white to pale fawn, thin, woody, scaly, dehiscing by breaking away from the point of attachment to the stipe, splitting vertically into a small number of rays which bend outward and upward, and finally falling away completely. Stipe tapering upwards, produced into a percurrent columella, bulbous at the base, concolorous with the cap, scaly, longitudinally furrowed, hollow. Gleba copious, ochraceous, blood colour or black, capillitium of spirally thickened, dark hyphae, the spirals sometimes uncoiling to produce ribbons; spores of the basic secotioid type, straw-coloured to dark mahogany, $8\text{–}18 \times 7\text{–}14\mu$.
HABITAT: On the ground in exposed, dry situations, or on the tops of termitaria.
DISTRIBUTION: Widespread in tropics and subtropics.
MATERIAL EXAMINED: KENYA: W. J. DAWSON, coast nr. Mombasa, rec. 6.8.1914; T. D. MAITLAND 531, Mombasa, rec. 31.1.1921; P. R. O. BALLY B 2185, Garissa, in open country, common, 4.2.1943; BALLY B 3169, Nairobi-Magadi road, nr. Gill's Gulch, 2,400 ft., 20.6.1944; RAYNER 733, Nairobi-Magadi road, nr. Olorgesailie, sandy soil above termites' nest, 1944; BALLY 7778, idem, 23.4.1950; Watamu, nr. Gede (R. W. R's notes).

PHALLACEAE

This family and the closely related Clathraceae are recognizable by their delicate, ephemeral, usually spongy receptacles which develop inside a globose "egg", bursting from it at maturity, exposing the foetid, mucilaginous gleba to the attentions of insects.

In the Phallaceae itself the mature fruit-body consists of the volva, or ruptured remains of the peridium, from which springs a hollow, chambered or spongy stipe holding aloft the gleba.

The Scale in the figures represents 10 microns (0.001 m.m.)

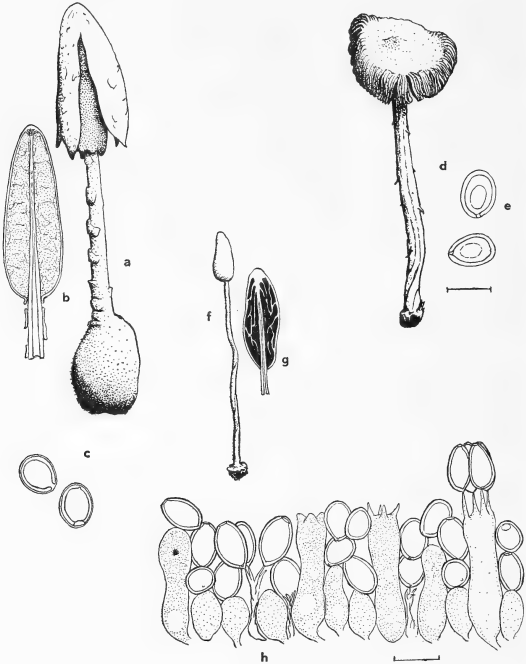

Fig. 1. Podaxaceae and Secotiaceae. a-c, *Podaxis pistillaris*: a, habit $\times \frac{1}{2}$ (RAYNER 739, from watercolour by E. M. Rayner); b, v.s. upper part; c, spores (RAYNER 739); d-e *Montagnea arenaria*: d, habit $\times$ 1; e, spores (from pictures by N. Otieno); f-h *Galeropsis* aff. *paradoxa*: f, habit $\times \frac{1}{2}$; g, v.s. upper part, $\times$ 1; h, v.s. hymenium (DEDAN 1233).

In *Mutinus* the gleba is borne directly on the stipe near its apex, but in most other genera, e.g. *Phallus*, it is borne on a more or less campanulate cap which fits over the apex of the stipe. An auxiliary structure, the indusium, is present in some species. It is a conical network suspended from near the apex of the stipe and hanging round it, under the cap.

Variations in the nature of the glebiferous part of the receptacle are the main criteria on which the family is divided into genera and species.

The structure of the egg of *Phallus* is shown in Fig. 2b.

Mutinus Fr.

Receptacle a hollow, fusiform stipe bearing the gleba directly on the upper part.

A species (almost certainly *M. argentinus* Speg., see Dring, 1964) having a red, acute glebiferous part and a slender, paler stipe has been seen in Kenya on several occasions but no material has been preserved. A similar plant from Tanganyika (Suji Mission, Makanyu, 4,000 ft., Jan. 1945, coll. BALLY) is preserved in Herb. EA, but paucity of the material precludes accurate determination.

Phallus Pers.

The receptacle, when expanded, consists of a hollow stipe with a volva at the base and a campanulate, glebiferous cap at the apex.

The wall of the stipe may consist of a spongy mass or a more or less clearly defined double layer of chambers, or a single layer of large chambers. We shall therefore refer to the chambers as multi-sub-bi- and uniseriate. The chambers may have holes in their walls opening to the exterior of the stipe or into its hollow exterior, or they may be intercommunicating. The tissue of the stipe may be white or some hue of red or orange.

The cap consists of a thin basal membrane thickened in places by surface ornament. The ornament may be rugulose, papillate, or tuberculate, or consist of a bold network of folds or ridges, in which case it is called reticulate. The cap is white or occasionally orange.

Cap and stipe are usually perforate at their common apex, sometimes barely perceptibly so, sometimes widely. The perforation is surrounded by wide or narrow ring of rather solid, undifferentiated tissue apparently belonging neither to cap nor to stipe. This collar serves as an "egg-tooth", rupturing the peridium when the fruit-body expands.

In some species an indusium hangs down from near the apex of the stipe, under the cap. It is perforated to a greater or a lesser extent, forming a network when fully expanded. It is customary to segregate those species possessing an indusium under two other generic names: *Dictyophora*, in which the cap ornament is reticulate, and *Clautriavia*, in which it is usually described as rugulose. However, the indusium alone is inadequate as a criterion on which to base a genus. In *P. impudicus*, the common European species and type of the genus, an indusium is occasionally present, though other fruit-bodies growing from the same mycelium are without. Closer observation shows that normal fruit-bodies of this species possess the rudiment of an indusium, visible, in microscopic preparations, as a ring of tissue near the apex of the stipe.

P. rubicundus (Bosc) Fr., (Fig. 2d)

Egg globose to obovoid, strongly rooting, often by a single strand; peridium white to pale brown, dehiscing apically. Receptacle to 15 cm. high, stipe hollow, wall spongy, c. 3 mm. thick, multiseriate, with chambers intercommunicating and often perforated to the exterior, flesh colour. Pileus campanulate, concolorous with stipe or darker, imperforate, surface rugulose, sometimes almost smooth. Gleba olivaceous, mucilaginous, foetid; spores ovoid-cylindrical $3.5–5 \times 1.5–2.5\mu$ smooth, tinted.
HABITAT: on the ground in forest or in the open.
DISTRIBUTION: Probably throughout tropics and subtropics.
NOTES: The typical form, to which the above description exclusively applie, has a robust, spongy, flesh-coloured stipe. The cap is more or less campanulate and the apex is imperforate. In a previous paper (Dring, 1964) an attempt was made to indicate some of the variation encountered within this so-called species. It seems questionable that such a diversity of plants can profitably be grouped under the same name. As more material is examined a number of well marked types, sometimes of apparently limited geographical distribution, emerge. One of them is dealt with below, in the status of a variety.

Orange, truncate forms with thin cap closely applied to the stipe are often separated, with a good deal of justification, as *P. aurantiacus* Mont. The description suggests that *P. armeniacus* Patouillard (1924), described from Madagascar, would be referable here, but no material of this has been seen.

P. rubicundus var. *gracillimus* Dring & Rayner, var, nov. (Fig. 2c)

A typo differt in stipite gracillimos, pariete tenui, e strato unico cubiculorum sistente.
TYPUS: BOWKER, Kitale, Kenya, Nov. 1960 (EA).

Egg globose to ovoid, to 2 cm. wide; peridium light coloured, dehiscence circumscissile or by an apical slit. Receptacle consisting of stipe and cap; stipe red or pink, slender, to 20×1 cm., attenuated apically, often curved in an arc, hollow, the wall thin, uniseriate, of large imperforate chambers; cap narrowly campanulate, thin, very finely rugulose to almost smooth. Gleba of the usual type, spores $3–4 \times 2\mu$. Hab. In turf, presumably ephemeral.
DISTRIBUTION: S. and E. Africa.
MATERIAL EXAMINED: KENYA: BOWKER, Kitale, Nov. 1960 (EA); BALLY 6377, Soy, alt. 6,000 ft., on a Kikuyu-grass lawn, 30.6.1948 (painting by C. Cripps, EA).
NOTES: This variety differs from the type in the extremely slender, long stipe consisting of a single layer of chambers. So far as can be ascertained from the dried material and the coloured drawing at our disposal the cap is thinner than that of *P. rubicundus*, more narrowly campanulate and not pink but yellowish-brown. The cap is also perhaps less rugulose than that of *P. rubicundus* but not too much stress should be placed on this rather variable character.

P. rubicundus var. *gracillimus* is similar to *P. novae-hollandiae* Cda, (= *P. gracilis* Lloyd, nom. invalid., = *Ithyphallus aurantiacus* var. *gracilis* E. Fisch., ? = *P. caleyi* Berk.), which, however has a shorter, biseriate stipe. We have hesitated to give our variety specific rank, or to place it as a variety of *P. novae-hollandiae* until more is known about variation in *P. rubicundus* and its allies.

Phallus caliendricus Dring & Rayner sp. nov. (Pl. 1)

Ovum subglobosum, sordide album. Receptaculum stipitatum; stipite incarnatum, usque 10×2 cm. fusiforme vel columnare, cavum, pariete spongioso, e stratis c. 4 cubiculorum sistente; cubiculis plus minusve intercommunicantibus. Mitra campanulata, tenuis; reticulis lamallarum lacerarum et tuberculorum dense vestita, apice primo clausa dein perforata. Gleba olivacea, mucilaginosa, foetida; sporis ovoideo-cylindraceis, $4-5 \times 2\mu$, laevibus, hyalinis. Hab ad terram.

TYPUS: RAYNER 513, Regio Hombe, Mons Kenya, Africa, 15.11.1951 (K).

Egg subglobose, dirty white, strongly rooting by a cord-like mycelial strand. Receptacle stipitate; stipe flesh colour, to 10×2 cm. broadly fusiform or columnar, apically attenuate, hollow, the walls about 3 mm. thick, spongy, multiseriate, with up to about 4 layers of more or less intercommunicating chambers. Cap campanulate, 2 cm. long by 1.8 cm. wide at the margin, dull, slightly orangy-red under the olivaceous gleba, surface thrown into very irregular, torn, thin folds, mostly about 1 mm. high but with nodular outgrowths which may attain 2 mm. in length, the whole giving the appearance, after removal of gleba, of a matted wig; margin white, about 1 mm. wide, slightly thickened, formed by the confluence of the folds of the cap; apex at first closed, perforate later; collar prominent, c. 5 mm. diam. Gleba dark olivaceous, mucilaginous, strongly foetid as in *P. impudicus*, spores $4.5 \times 2\mu$, ovoid-cylindrical, hyaline, smooth.
HABITAT: On the ground.
MATERIAL EXAMINED: KENYA: RAYNER 513, Hombe distr., above River Research Centre, slopes of Mt. Kenya, 6,500 ft., 15.11.1951 (Type, K, with watercolour); BALLY 9722, Nairobi distr., Lukenya, below E. slope, 5,500 ft., 20.5.1954 (EA).
NOTES: This species is distinguishable from *P. rubicundus*, which it resembles in its habit, by the cap ornament being like that of *Itajahya*, though less well developed. Indeed this species may be a link between that genus and *Phallus*.

P. indusiatus Vent. ex Pers. (Fig. 2a)

MATERIAL EXAMINED: SEYCHELLES: C. JEFFREY, s.n., Praslin, Valée de Mai, 1962 (coloured slide only, K); JEFFREY, s n , without data (K). UGANDA: SIR W. JOHNSTON, Bt., no data, ? 1901 (K); C. B. USSHER 78, Mabira Forest, April 1908 (K); LISTER, Ishanta R., Kigezi, 31.8.1960 (photo only, K). TANGANYIKA: SIR J. KIRK, Newala, Rovuma R. [S. Tanganyika], 1886 (picture only, K); K. BRAUN, 691 [Usambaras] 28.6.1905 (EA); BRAUN 1554, Kiv, nr. Vuga [Usambaras] (EA); BRAUN 8624, Amani (E.A.).
NOTES: This is the common tropical, white "Dictyophora" and is characterized by its well developed. widely spreading indusium and the small reticulations of the cap ornament (up to about 2 mm, diam.). USSHER 78 has particularly narrow reticulations, mostly about 0.5 mm. diam.

The record from Valée de Mai is of an example with a double stipe and common cap, indusium and volva.

P. duplicatus Bosc (Fig. 2b)

Egg subglobose, to about 4 cm. diam., dirty white to brownish, strongly rooting, dehiscing apically. Receptacle consisting of stipe, indusium and cap; stipe white, to 15×3 cm. almost cylindrical, hollow, wall multiseriate, white; indusium short, often scarcely protruding below margin of cap, not widely spreading, the perforations small especially near the margin where they may be absent or hardly perceptible; cap campanulate, deeply reticulate, the primary reticulations up to about 5 mm. across in medium-sized fruit-bodies, collar narrow, often long-elliptical, apical perforation conspicuous, also elliptical. Gleba of the usual phalloid type, smell slightly offensive; spores smooth, elliptical $2.5–3.5 \times 2\mu$.
HABITAT: On the ground, usually in woodland.
DISTRIBUTION: N. America, E. and S. Africa, W. Europe.
MATERIAL EXAMINED: KENYA: Rayner, Upper Kiambu, coffee estate, c. 6,200 ft., 1943 (K).
NOTES: This is immediately distinguishable from *P. indusiatus* by the larger reticulations of the cap, the more massive stipe, and the shorter, less widely perforate and narrower indusium. Coker & Couch (1928) state that the indusium of United States examples is light rosy pink and Smith (1951) says "white to pinkish" but the specimen from Kenya had a white indusium.

In the above collection, which is in spirit, the indusium scarcely protrudes below the cap and the perforations, even above, are poorly developed.

From the illustrations in Bottomley (1948) and the single specimen in K (J. Medley Wood 667, in bush, Inanda, Natal, leg. W. Haygarth, rec. 27.12.1881, with picture) it would seem probable that this, not *P. indusiata*, is the correct name for the S. African examples.

Records of this species in W. Europe are open to suspicion because of confusion between it and indusiate forms of *P. impudicus*. It is tentatively suggested that the main distinction between them lies in the structure and shape of the indusium, which is widely spreading, cobwebby, in the latter. General habit and the character of the reticulations of the cap are important additional distinctions. The difference between the two plants is magnificently demonstrated by Pilát (1958, Fig. 16, p. 74).

P. hadrianii Vent. ex Pers. (= *P. imperialis* Schulzer)

MATERIAL EXAMINED: SEYCHELLES: Jeffrey, s.n., Mahé Brillant, 7.10.1961 (with coloured slide, K).
NOTES: This species differs from *P. impudicus* mainly in its less disagreeable smell, in the pink colour of its volva, volva gel and, often, of its stipe, in the more broadly based egg, and in the more nearly isodiametric reticulation of the cap. The cap is said to be less abruptly conical and the apical perforation consequently wider but this may be of little diagnostic value (Meulenhoff, 1936). It has been argued with some justification that it is merely a variety of *P. impudicus*.

Jeffrey's material conforms with the usual concept of this species, except that the stipe is uniformly pale pink whereas it is usually white or coloured only at the base. Its occurrence in the Seychelles is not so strange as would appear at first sight since many records of *P. impudicus* from Asia are probably referable to this species (Dring & Rayss, 1964). Pearson (1948) records *P. hadrianii* from S. Africa.

CLATHRACEAE

This group is closely related to the Phallaceae but differs in that the receptacle is more complicated and more variable. It may be sessile or stalked, and consist of a network or of variously united arms or diverging branches. The gleba is borne directly on the adaxial face of the networks, arms, etc., in immediate contrast to the situation in the Phallaceae, where the gleba is always borne externally to the receptacle.

The egg (Fig. 2g) differs from that of the phalloids in that the gelatinous "inner peridium" is not a continuous layer but is divided into segments by peridial sutures. These are membranes which connect the outer peridium with the receptacle, passing approximately radially through the gelatinous layer. A peridial suture corresponds to each arm of the receptacle. The lines of fusion between the peridial suture and the peridium can be seen as slight folds running over the outer surface of the unopened egg.

The genera of Clathraceae are interdistinguishable by the shape of the receptacle. Unfortunately rather few are known to us from this area. In *Clathrus* the receptacle is a hollow network, and all other forms may be considered to be derived from this.

Ileodictyon is a close relative of *Clathrus* in which the receptacle, instead of consisting of chambered tissue, is formed of a continuous, intestine-like tube (Reid & Dring, 1964). *I. cibarius* Tul. is recorded from Salisbury (see Bottomley 1948, p. 528).

Loss of all but the vertical arms of the network has resulted in genera like *Linderiella* (Fig. 2e) and *Blumenavia*, both of which have E. African representatives.

Another line of evolution has given rise to stipitate forms represented in the E. African flora by *Simblum* and *Kalchbrennera* (Fig. 2f, i).

Clathrus Mich. ex Pers.

Receptacle a hollow, more or less spherical lattice. The gleba may cover the whole inner surface of the receptacle or be restricted to the intersections of the arms of the network. The arms consist of a more or less regular arrangement of chambers though this structure may be obscured in the more massive, spongy species.

Only one record is known to us from E. Africa (MAITLAND, without data, Uganda, photograph only, in Herb. K). The fruit-bodies (Fig. 2h) are white or pale-coloured and have rather characteristic flat meshes as in Mme. Goosens-Fontana's illustration (in Dissing & Lange, 1963). Dissing and Lange have taken this to be *C. baumii* P. Henn., with good reason. Though the illustration does not indicate that the gleba is confined to nodular processes at the intersections of the arms as Hennings's (1903) original description specifies, study of the dried material (BR) shows this to be so.

This fungus must be very similar if not identical to that recorded from Jamaica by Dennis (1953) as *C.* cfr. *preussii*, from typical examples of which it differs in the flatter arms, more nearly quadrilateral in section, lacking a fringe along the outer angles (Dring, 1964).

Linderiella G. H. Cunn. (=*Linderia* Cunn. non *Lindera* Thunb.)

Receptacle of vertical, unbranched (exceptionally forked) columns united at the apex but free at the base. The gleba is borne directly on the inside of the apical part of the columns.

There is only one known species.

L. columnata (Bosc) Cunn. (= *Laternea columnata* (Bosc) Lloyd) (Fig. 2e)

Egg subglobose with longitudinal furrows corresponding to the peridial sutures and hence to the columns of the receptacle, to about 5 cm. diam., white to pale brownish, usually with a single thick rooting strand. Receptacle orange to bright red, at first urceolate to ovate, becoming obovate as the top part expands fully, of 2–4 thick columns which are gradually attenuated toward the apex where they are united, abruptly tapering below where they are free, up to about 2 cm. across at the widest part. Gleba borne in a single large mass initially spherical and pendant from the top of the receptacle, as the latter opens dequescing and forming a more or less even coat over the inner surface of the upper part of the columns. Gleba and spores as usual for the family.

HABITAT: On the ground.

DISTRIBUTION: The Americas, Africa south of the equator, Japan, New Zealand.

MATERIAL EXAMINED: KENYA: E. R. NAPIER, s.n., Kiambu, 5,700 ft., Dec. 1931, coll. MRS. ARMSTRONG (K); RAYNER 736, Scott Laboratories, Nairobi, 6,300 ft. (K); MRS. P. H. IRWIN 613, Peover, Mt. Elgon, 10.6.1962 (watercolours only, K); MRS. W. STEVENS, Nairobi, 30.4.1964 (EA).

NOTES: This is very closely related to a section of the genus *Clathrus* and indeed the tendency of its columns to branch in exceptional cases, makes it very difficult to draw a water-tight distinction between the two genera. (See Coker & Couch (1928), Pl. 1. for an excellent illustration of a *Clathrus*-like specimen. These authors, in fact use the original binomial *Clathrus columnatus* Bosc.). Specimens from Japan with only two columns have been segregated as *L. bicolumnata* Lloyd. Specimens from the E. Rift valley have only two columns though one of the specimens from Mt. Elgon illustrated by Mrs. Irwin has three.

Specimens of *L. columnata* have sometimes been confused with *Anthurus* but should be immediately recognizable in that the columns of the receptacle are united below into a short stipe in the latter. They are also initially joined at the apex of the receptacle but later become separated and flaring.

Hennings (1904) recorded *Anthurus* sp. from the Usambaras but it was badly damaged. It seems probable that it was *A. archeri* which is known from S. Africa, though only from oakwoods near the S.W. coast, but it cannot be entirely excluded that it was in fact a *Lysurus*.

Blumenavia Möller

Receptacle of vertical columns, united at the apex, free at the base, the sides of each column fringed by irregular, torn wings which bear the gleba.

The special glebiferous organ is developed from the large adaxial chamber of the arm. The wall of the chamber is specially thickened except on the adaxial side where it is defective. At maturity it ruptures along this vertex and the thickened walls are free to fold sideways and forwards as irregular flaps carrying the greater part of the gleba with them.

In *Laternea* Turpin, another genus of Clathraceae, special glebifers are also developed from modified receptacular chambers. Since they are similar in habit to *Blumenavia* a good case might be

made for uniting the two, though this will not be undertaken here. For an account of two species of *Laternea* and one of *Blumenavia*, see Dennis (1953).

This series of forms with columns discontinuous at the base, including *Linderiella* and *Blumenavia* and ending in *Laternea* is one of the most complete and beautiful in the Clathraceae. It illustrates the loss of all but the vertical arms of the receptacle, and their reduction in number, the vertical displacement of the gleba, development of a special glebiferous organ (cf. the cap of *Phallus*) and reduction in size of the receptacle.

But one species of *Blumenavia* is known from E. Africa.

B. usambarensis P. Henn.

Egg blotched with brown, subglobose, to 4 cm. diam. opening by a series of large irregular apical lobes. Receptacle white, long-ovoid, to about 8×3 cm. consisting of 3–5 vertical columns free below and joined at the apex, to 1 cm. thick at the base, attenuated apically, outer surface strongly transversely ridged, sub-triangular or quadrilateral in section, broadest side outermost. Glebiferous wings raggedly dentate, extending along the whole length of the inner angle of the side of the columns. Gleba of the usual type, probably restricted to the upper part of the receptacle. Spores of the usual type, $3–3.5 \times 1.5\mu$.

NOTES: We have seen no E. African material of this very rare fungus and the description is made up from Hennings's (1902) original and studies of a W. Indian collection in Herb. K (R. W. G. Dennis, s.n. Noronja, Trinidad, rain forest, 1,800 ft., 2.10.1949, with watercolour). This species would seem to differ from *B. rhacodes* Möll., the type species, in the position of the glebiferous wings, and in the much more fragile construction of the receptacle, which is white instead of red. Hennings does not mention that the gleba is restricted to the upper part of the receptacle but this seems likely.

Laternea angolensis Welwitsch & Currey (1870) may be the same according to the original account. There is no type specimen in herb. BM.

Simblum Klotzsch

Receptacle consisting of a stipe surmounted by a clathrate, fertile network. The copious gleba s borne on all but the flattened outer face of the arms of the network.

Morphologically this may be regarded as a stipitate *Clathrus*.

Although basically globose, the head may be depressed onto the stipe so that it appears hemispherical. The colour of the receptacle may be white or some tint of yellow or red. The gleba may vary in the extent to which it covers the sides and exterior of the arms. The fertile network is usually abruptly differentiated from the stipe but occasionally there is a gradual transition.

The fertile network varies considerably in the number of meshes (about 5 to about 25) and in their size and shape. Conard (1913) reports finding occasional arms of the network embedded deep in the gleba. Ahmad's (1952) implication that the irregularity of the network in some specimens brings them very close to *Lysurus* is interesting and is confirmed by material in K (Varanasi, India, coll. K.B. Khare). The genus does share with *Lysurus* the tendency of the gleba to migrate towards the outside of the arms, a tendency which is even more marked in the next genus, *Kalchbrennera*.

The number of species in the genus is a matter of dispute. The original one, *S. periphragmoides* was yellowish in colour and came from Mauritius. Specimens from the Old World are normally placed in this species and are usually some shade of yellow.

Reddish (occasionally white) species usually come from the New World and are usually called *S. sphaerocephalum* (inappropriately, perhaps, since the "hemispherical" head is commoner in New World than in Old World forms.

There are, however, notable exceptions to the hypothesis that colour depends on distribution. A yellow form from Texas has been described as *S. texense* (Atkinson & Long) Long, and Ahmad's (1952) Pakistani collections are apparently red rather than yellow.

We have seen no substantiated record of a *Simblum* from continental Africa, all supposed examples being referable to *Kalchbrennera*.

S. periphragmoides Klotz. (Fig. 2i)

MATERIAL EXAMINED: MAURITIUS: Mrs. A. Telfair, Bois Chéry (K) (TYPE).
ZANZIBAR: Mrs. H. Faulkner, Massazine, among grass in sandy soil, 19.11.1957 (K), and another collection, in spirit, without date (K).

NOTES: The Zanzibar collections comprise rather small fruit-bodies with the "hemispherical" head (Fig. 2i). They are described as having been orange. The stipe wall consists of 2–3 layers of chambers thinning to one layer at the top and bottom. The chambers are arranged in broken vertical columns and many of them communicate with chambers above and below to form vertical tubes. The receptacular network consists of an apparently continuous tube whose walls are rather thicker

than those of the chambers of the stipe. The veil which lined the inside of the hollow stipe before expansion of the fruit-body persists as a short flaccid cylinder hanging down inside the stipe. The anatomical details correspond closely with those described by Long (1907) for *S. texense*.

Kalchbrennera Berk.

Receptacle like that of *Simblum* except that the fertile network is less well developed and bears simple or forked processes on its outer side at the point of intersection of the arms. The gleba is borne between these processes, that is on the outside of the network, not inside it as in every other clathroid.

The position of the gleba is surprising. However, the ends of the processes are external to the gleba. A tendency for the gleba to migrate round the sides of the arms and to take up a position more or less exterior to the receptacle has already been noted for *Simblum* and *Lysurus*. Presumably this is an extension of that process.

The genus contains a single species.

K. corallocephala (Welw. & Curr.) Kalch. (=*Simblum clathratum* Lloyd) (Fig. 2f)

Egg subglobose, becoming obovoid, to about 4 cm. diam. Network of receptacle bright red, hemispherical, to 3 cm. diam., meshes very variable in number, arms transversely rugulose, tubular, to 3 mm. diam., appendages bright red, branched or simple, projecting up to 2 cm. from the network, often smaller. Stipe cream-coloured, often tinged with pink above, cylindrical or attenuated downwards, to 12×3 cm., hollow, walls sub-biseriate, the larger chambers internal, often intercommunicating to produce short vertical tubes. Gleba as normal for the Clathraceae, particularly foetid, spores normal.
HABITAT: On the ground, in woodland or in the open.
DISTRIBUTION: Apparently limited to Africa south of the Sahara.
MATERIAL EXAMINED: KENYA: Rayner 738, Bamboo forest Central Prov., c. 7,000 ft., 1947; Bally B6349, Karen Estate, Ngong Distr., leaf mould in forest, May 1948 (EA); B9721, Spring Valley, Nairobi, coll. H. Stone, May 1954 (EA); B11575, Karen Estate, Nairobi Distr., coll. Mrs. J. Pedfield, 19.5.1957 (K, in spirit); L. D. & B. Verdcourt 2066, Muguga, nr. Nairobi, edge of cultivated field and natural woodland, 16.12.1959 (EA); L. D. Verdcourt H201/61, Muguga, nr. Nairobi, in grass, 23.5.1961 (EA).

SCLERODERMATACEAE

This family is characterized by the possession of a more or less globose, sessile or stipitate, usually epigeal fruit-body. The peridium consists of a single layer, being thick or thin, tough or fragile at maturity, continuous with the tramal plates. The gleba is divided into discrete knots of tissue separated by the anastomosing tramal plates. It is not labyrinthine as in the Phallaceae and Lycoperdaceae, nor can it be said to be divided into chambers since there is virtually no hymenium, the basidia and their supporting hyphae forming loosely woven islands of tissue without a central cavity. The basidia apparently become functionless before the spores are fully grown and nutrition of the spore continues through a placenta of hyaline cells which envelopes each spore. The exact nature of the placental cells seems to determine the characteristic ornament of the mature epispore. Mature spores are usually relatively large and strongly ornamented with prominent spines or a deep reticulum, or often a combination of both.

The tramal plates are more or less persistent at maturity, dividing the gleba into distinct pockets, often called peridioles.

The two best known genera are *Scleroderma* and *Pisolithus*. The latter is not represented in the E. African material at our disposal, though its only widespread species *P. arrhizus* Pers. (=*P. tinctorius* (Mont.) Fisch.) may occur in the dryer areas. Its fruit-bodies are dark brown, very hard, stipitate, dehiscing by irregular erosion from the apex. The tramal plates are very prominent and split down the middle so that each peridiole breaks away as a separate grain.

The tramal and other tissue yields a yellowish dye. Pseudomycorrhizal association with *Eucalyptus* and probably other trees has been demonstrated.

Scleroderma Pers.

Tramal plates breaking down at maturity resulting in a pulverulent gleba consisting of spores plus large quantities of debris derived from the trama, placentae, etc., and often obscuring the ornamentation of the epispore.

The peridium just before it dries out at maturity is always fairly thick (1 mm. to 1 cm.), brittle or tough when dry. Dehiscence is by more or less regular stellate cracking of the peridium and

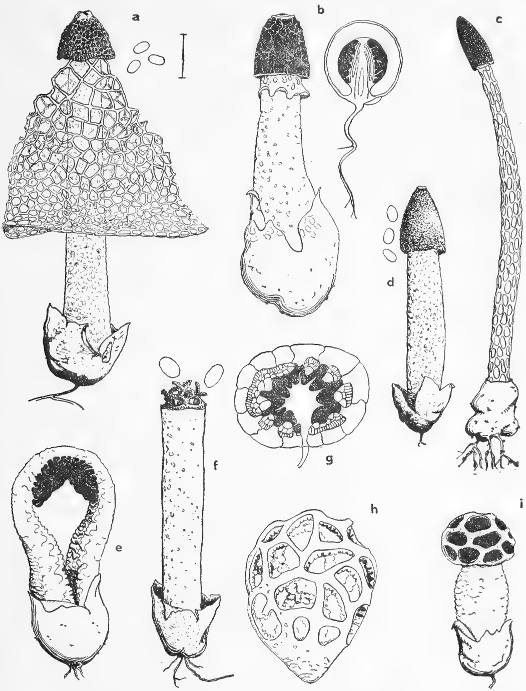

Fig 2. Phallaceae and Clathraceae. a, *Phallus indusiatus*, habit $\times \frac{1}{2}$ and spores (from W. African material); b, *P. duplicatus*, habit and v.s. egg, $\times \frac{1}{2}$ (RAYNER 737, from watercolour by E. M. Rayner); c, *P. rubicundus var. gracillimus*, habit $\times \frac{1}{2}$ (from watercolour by C. Cripps); d, *P. rubicundus*, habit $\times \frac{1}{2}$ and spores (from W. African material); e, *Linderiella columnata*, habit $\times \frac{1}{2}$ (from watercolour by Mrs. Irwin); f, *Kalchbrennera corallocephala*, habit $\times \frac{1}{2}$ and spores (from W. African material); g, *Clathrus* sp. v.s. egg $\times \frac{1}{2}$ (W. Indian material, from watercolour by R. W. G. Dennis); h, *Clathrus* sp., habit $\times \frac{1}{2}$ (from photo by T. D. Maitland); i, *Simblum periphragmoides*, habit $\times$ 1 (FAULKNER).

recurving of the resulting lobes, or by irregular flaking away of the apex. The most important characters for distinguishing between the species are thickness of the peridium, mode of dehiscence and spore-size and ornament.

S. verrucosum Vaill. ex Pers. ssp. *verrucosum* (Fig. 3c)

Fruit-bodies depressed globose, to about 6 cm. diam., usually less, usually with a short stipe but sometimes practically sessile or with a very long stalk. Peridium when dry, less than 1 mm. thick, fragile, with small, brown, angular, firmly attached scales. Spores globose, strongly echinate 7–12μ diam., not including the spines, which are up to 2μ long, curved and acute.
DISTRIBUTION: Cosmopolitan.
MATERIAL EXAMINED: RHODESIA: EYLES HERB. 7222, Salisbury, Feb. 1932 (as *S. nitidum* Berk.) (K).
NOTES: This subspecies must be relatively common in the area though we have seen only one gathering. Bottomley (1948, p. 538) records it for S. Rhodesia and Lloyd (L. 12, p. 1 (Vol. 2) 1906) for the Usambaras.

The length of the stipe in some collections is extreme. These have often been described as separate species (see Dring, 1964).

S. verrucosum ssp. *bovista* (Fr.) Sebek is similar to ssp. *verrucosum* except that specimens with very long stipes are not found, and the ornament on the spores is a coarse reticulum. Intermediates between the two subspecies exist in which the epispore is partly spiny, partly reticulate. Bottomley (1948, p. 540) records ssp. *bovista* from Rhodesia (as S. *bovista*).

S. flavidum Ellis & Everhart (Fig. 3a, b)

Fruit-bodies depressed globose to pyriform, to 6 cm. diam. dehiscing by apical lobes which become partly reflexed, usually with a well-developed stem-like base. Peridium buff, up to 5 mm. thick when fresh, usually more than 1 mm. when dry, smooth, or the upper part deeply cracked or areolate. Gleba usually with a yellowish tinge, powdery, often falling away completely leaving the empty star-shaped peridium. Tramal plates often rather persistent. Spores dark brown, echinate, 10–14μ.
DISTRIBUTION: N. America, Australasia, E. and S. Africa.
MATERIAL EXAMINED: KENYA: C. LEAKEY, s.n., Nairobi, Apr. 1964 (K, EA); UGANDA: MAITLAND 593, Kampala, Sept. 1922 (as *S. geaster*, K); TANGANYIKA: GIBSON, s.n., Golongolo, nr. Lushoto, profuse under *Pinus radiata* suggesting mycorrhizal association, 6.7.1959 (as *S. bovista*, K).
NOTES: This is rather a variable species recognizable by its stellate dehiscence, spore and peridial characters and sterile base. It differs from *S. geaster* in the thinner peridium and in that the spines on the spores are not reticulately arranged.

Authentic material in Herb. K (ELLIS & EVERHART, N. Amer. Fungi Exs., 2 ser., 1698) has spores with very thin sharp spines but other material shows a great deal of variation in this respect. In Leakey's specimen, the habit of which is absolutely typical of the species, the ornament of the epispore is reduced to warts. MAITLAND 593 has more typical spores but the fruit-bodies are very depressed in shape and most of them lack a sterile base. The upper part of the peridium is deeply cracked after the manner of some N. American specimens (see Coker & Couch, 1928, pl. 88). Gibson's specimen is immature and can therefore only be tentatively placed here.

S. capense Lloyd (Fig. 3d)

Sporocarp small, to almost 1.5 cm. diam., more or less subterranean, sessile, rooting by a mass of fine basal strands. Peridium smooth to minutely cracked, often finely wrinkled on drying, dull ochraceus, very thin and brittle when dry. Gleba reddish-brown; tramal plates yellow, not persistent; spores globose, (7.5)–9–14μ, strongly echinulate with warts grouped together, almost free from debris.
DISTRIBUTION: Southern Africa.
MATERIAL EXAMINED: KENYA: THOROLD T36, Njoro, 7,000 ft., July 1932 (K).
NOTES: The specimen corresponds with the description given by Lloyd and Bottomley (1945, p. 540–1) except that the material is caespitose. Neither Lloyd nor Bottomley mention that the spines of the epispore are grouped together in clumps.

Bottomley suggests that the species may be the same as *S. cepa* but the peridium is far too thin for that species, and the colours are wrong. The reddish tinge of the gleba at least in the stage immediately before it becomes powdery, is striking.

NIDULARIACEAE

Members of this family are characterized by the small (never much exceeding 1 cm. diam.) cup-shaped peridium containing a gleba composed of seed-like peridioles, of which there are usually

more than one per fruit-body. They are held in place in the cup until maturity by mucilage or anchored to its wall by a cord, the funicle. Spores are large, pale, thick-walled, smooth and subspherical to ovoid.

The peculiar habit of these fungi gives them the name "birds'-nest" fungi. They have been provisionally placed next to the Sclerodermataceae in this paper because of the similarity of organization in which the gleba is divided into discrete peridioles. In addition, a true hymenium is absent and the spores are nourished by placentae as in *Scleroderma*.

The more advanced, funiculate genera are best known, both taxonomically and developmentally, but more detailed study of the simpler members of the group may lead to a better understanding of their relationship to the rest of the gasteromycetes.

There is a closely related family, the Sphaerobolaceae, containing only one accepted species *Sphaerobolus stellatus* Tode ex Pers. The fruit-bodies are up to about 2 mm. diam., cup-shaped, and the single peridiole is discharged explosively by the inner layer of the peridium suddenly turning inside-out. *S. stellatus* is cosmopolitan, occurring on decayed wood, dung, etc., but it is easily overlooked, and apparently not yet recorded for E. Africa.

Cyathus Haller ex Pers.

Cup obconical with a compound wall to which the peridioles are attached by a complex funiculus. Periodioles dark-coloured, covered by a dark cortex which is sometimes overlain by a thin translucent tunica. They are dispersed by rain-drops falling asymmetrically into the cup, ejecting the peridiole.

As seen in transverse section the cup wall consists of an outer layer of narrow, branched, densely woven hyphae orientated more or less parallel to the surface and bearing the tomentum, if any, on the outside, a middle layer of pseudoparenchymatous tissue, and an inner layer of loosely woven hyphae bounded internally by a cuticle.

There has been much confusion about the anatomy of the peridiole, which is regrettable since its various features are used as taxonomic criteria. For the moment, following Brodie & Dennis (1954), the appearance of the walls of the peridiole as seen in relatively thick sections such as are usually obtained by cutting the soaked-up peridiole with a razor-blade has been used as a means of separating species. The terminology introduced by Lloyd (1906a) and accepted by Brodie & Dennis (1954) has been used, namely *tunica* for the outermost, hyaline layer, if any, and *cortex* for the dark-coloured layer or layers. This system is unsatisfactory, however, and stands in need of drastic revision.

C. microsporus Tul. (Fig. 3g)

Cups obconical or slightly flaring with very small mycelial emplacement at the base, 5–7 mm. high $\times$ up to 6 mm. wide at mouth, externally non-plicate, with a covering of shaggy to adpressed hairs, umber; inside rather greyer, smooth to very faintly plicate. Peridioles 1–2 mm. diam., dark brown, sometimes becoming silvery on drying, tunica thin, cortex single-layered, spores 6.5–5–9.5 $\times$ 4.5–6μ.
HABITAT: On rotten wood or soil associated with rotten wood.
DISTRIBUTION: Florida, W. Indies and tropical S. America, Southern Africa.
MATERIAL EXAMINED: KENYA: GIBSON 779, Kimothu Nursery, Mt. Elgon, soil close to rotten timber, Sept. 1961.
NOTES: The species is recognized by the combination of small spores and non-plicate cups. The published accounts differ in the size and shape given for the spores. Those of the above collections correspond with the figures given by Palmer (1961) for the type and other material. To judge by the various American collections in K, the outer surface of the cups usually has longer hairs than is the case with the African specimen.

Mattirolo (1924) records this species from near Meru Mission, Kenya, coll. Rev. Padre G. Balbo.

C. poeppigii Tul. (Fig. 3e)

Cups dark umber, obconical, to 8 mm. high and 8 mm. wide, fluted to shaggy on exterior, both inner and outer surfaces deeply fluted but fluting sometimes obscured on the outside by the hairs, ridges about 0.5 mm. apart. Peridioles black, shiny, to 2 mm. diam., tunica absent, cortex two layered, dull brown in section; spores ellipsoid, usually about 20–30 $\times$ 30–40μ but sometimes rather smaller in African material.
HABITAT: On wood or soil in contact with wood.
DISTRIBUTION: Widespread in tropics and subtropics.
MATERIAL EXAMINED: KENYA: BALLY 10446, Nairobi, 25.10.1955 (K); VERDCOURT 1894, Mrima Hill Forest, 6.9.1957 (K, as *C. limbatus*); UGANDA: W. SMALL 143, 1915; R. DUEMMER 2112, Kipayo, 4,000 ft., on log in forest, April 1915 (K).
NOTES: In addition to the above examples Lloyd (1906b) received it from Braun, Amani, Tanganyika.

This species greatly resembles *C. limbatus* in macroscopic features though the ridges are usually rather closer together. The spores of typical *C. poeppigii* are, however, twice the size of those of typical *C. limbatus*, and the cortex of the peridiole is composed of dull brown, not red brown hyphae as in the latter species.

SMALL 143, noted above, lacks mature spores but is probably this species.

C. limbatus Tul. (Fig. 3i)

Cups obconic, to 10 mm. high and 7 mm. wide, usually with prominent basal emplacement; outer surface dark rust colour, shaggy, fluted, the flutes about 0.75–1 mm. wide; inner surface greyish, fluted. Peridioles dark and shiny, with two-layered cortex, spores usually about 10–15 × 15–20μ.
DISTRIBUTION: Widespread in the tropics and subtropics.
MATERIAL EXAMINED: KENYA: R. M. NATTRASS, Nairobi, 5,700 ft., on bamboo trash (K, ex Herb H. J. BRODIE 1244); RAYNER 734, Karura Forest, nr. Nairobi, 5,700 ft., 1942; RAYNER 740, without data. UGANDA: A. FRENCH 29, Katonga Forest, Spring 1957 (K). TANGANYIKA: E. MILNE-REDHEAD & P. TAYLOR 9746, Kitai, Songea District, 880 m., on bare earth, probably associated with rotten wood, 17.4.1956 (K). ZAMBIA: ANGUS M68, Kawambwa, N. Prov., dead branch on forest floor, 30.10.1952 (K). MAURITIUS: AYRES, Pouce Rouge, 1861 (K).
NOTES: This species closely resembles the previous one except in spore-size. The cups are usually rather larger and more elongated with wider fluting.

The usual description of the cortex of the peridiole as being "two-layered" needs some qualification. The outer layer of the cortex is very thin, often consisting of a single layer of red-brown hyphae. In all but the very thinnest sections this layer usually becomes partly detached and tilted so as to appear thicker; in the very thin sections it usually becomes detached altogether.

FRENCH 29 has unusually narrow spores 14–6 × 6–7μ; RAYNER 734 very large ones, up to 30μ long.

C. triplex Lloyd (Fig. 3f)

Cups obconical, not fluted, externally coarsely felted, pale umber; internally light greyish-brown. Peridioles to 2 mm. diam., in dried specimens silvery on the upper surface where the tunica persists, dull grey below where it does not; cortex two-layered; spores narrowly to broadly ellipsoid, 13–20μ in major diam., smooth, often very thick-walled.
HABITAT: On dead wood.
DISTRIBUTION: Central or S. America, Ceylon, Mauritius, W. Africa.
MATERIAL EXAMINED: MAURITIUS: Suite des grandes pluies de mars (K, ex Herb. Berk. and Herb. Hooker, as *C. intermedius*).
NOTES: *C. triplex* differs from *C. pallidus* Berk. & Curt. in its darker cups with margin hardly or not reflexed, coarser tomentum, double peridiolar cortex and larger spores. *C. pallidus* is recorded from S. Africa (BOTTOMLEY, 1948 and a specimen in K, N. J. G. SMITH, Grahamstown, Jan. 1931).

C. rudis Pat. (Fig. 3h)

Cups campanulate, to 10 mm. high, 8 mm. diam., narrowly fluted, exterior dark reddish brown, strongly tomentose-scaly, the scales obscuring the flutes, interior pale silvery grey, the fluting emphasized by dark-brown striae on the upper half. Peridioles brown-black, spores ellipsoid 10–12 × 5.7μ.
HABITAT: On manure.
DISTRIBUTION: Madagascar, ? New Zealand.
MATERIAL EXAMINED: MADAGASCAR: Collector and locality unknown, Dec. 1932 (K, ex Herb. H. J. BRODIE 1118).
NOTES: The part of the collection in K consists of only one fruit-body, without peridioles. Brodie has annotated it: "seems to fit very well, few collections known".

The description of the spores is taken from Patouillard's original description and from New Zealand material in K which Brodie has annoted: "This is what New Zealand mycologists send me as *C. novae-zealandiae*. To me it is close to *C. rudis*". It is indeed strikingly similar to the Malagash material, the nature of the tomentum being a most distinctive character.

LYCOPERDACEAE

Sporocarps more or less spherical, sessile or carried on a pseudostem, that is a basal cylinder or inverted cone of spongy tissue whose elements are not orientated in the direction of the long axis of the fruit-body as is the case in the tissue of a true stipe. Peridium divided into two distinct layers, the exo- and endoperidia. Gleba pulverulent at maturity, consisting of globose or ellipsoid, usually ornamented spores, and, almost always of well-developed capillitium.

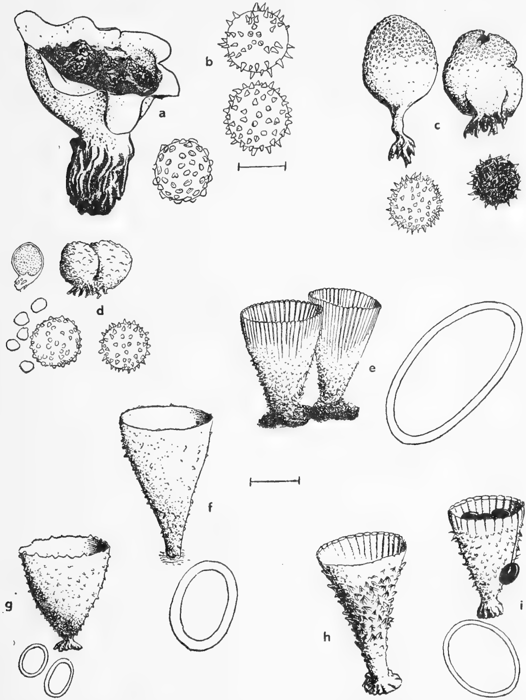

Fig 3. Sclerodermataceae and Nidulariaceae. a-b, *Scleroderma flavidum*: a, habit × ½ and spore (LEAKEY); b, spores (MAITLAND 593); c, *S. verrucosum* ssp. *verrucosum*, habit × ½ and spores, one with debris (EYLES 1222); d, *S. capensis* habit and v.s., × ½, spores and nurse cells (THOROLD); e, *Cyathus poeppigii*, habit × 2 and spore (BALLY 1046); f, *C. triplex*, habit × 2 (Mauritius); g, *C. microsporus*, and spores (GIBSON 779); h, *C. rudis*, habit × 2 (Madagascar); i, *C. limbatus*, habit × 2 and spore (RAYNER 734).

This family, as defined here, includes the familiar and successful puffballs (*Lycoperdon* and related genera), and the earth-stars (*Geastrum*).

A number of important organs are characteristic of this family, though none of them is absolutely diagnostic. Perhaps the most important of these is the capillitium. In the narrow sense in which it is used here, the word denotes the thread-like, thick-walled, tinted to dark-coloured mycelium which permeates the gleba. It is admitted that capillitum is not strictly limited to the Lycoperdaceae, and that there are a few species of Lycoperdaceae which lack true capillitium. Nevertheless, the presence of capillitium is the hallmark of the family.

Tramal remains which have not developed into true capillitium may also be present in the mature gleba. They are usually hyaline, collapsed, septate hyphae, often clinging together in bundles, or they may be less like ordinary tramal cells and more like immature capillitial hyphae. Such structures comprise the paracapillitium (Kreisel, 1962).

In members of the Lycoperdaceae and some other families capillitium is replaced by abundant paracapillitium. In some other cases paracapillitium is mixed with true capillitium in the same gleba. The significance of the various forms of capillitium and the various combinations of true capillitium and paracapillitium both taxonomically and as agents in the process of spore discharge is largely unknown and well worthy of investigation.

Knowledge of peridia is equally limited. Little is known about the relationship between the peridia in various families. Certainly wide homologies must not be drawn between the layers of the peridium of different families. The exoperidium of *Lycoperdon* should not, for example, be assumed to be the homologue of the outer peridium of *Tulostoma*. In this paper the terms exoperidium and endoperidium have been used only for the peridial layers of *Lycoperdaceae*. Where a double peridial layer is present in other groups the layers are called inner and outer peridia.

The pseudostem is an additional organ frequently found in the puffballs. It consists of glebal tissue which has become sterile and modified to fulfill a supporting function. Its glebal origin is reflected in its usually chambered structure. The absence of the true stipe in the Lycoperdaceae (and in the Phallaceae and Clathraceae) is interesting as it strongly suggests an origin from a sessile, probably hypogeal ancestor.

Lycoperdon Pers.

Sporocarp sessile or with pseudostem, dehiscing by an apical pore. Capillitium simple or branched, often arising in a central tuft or pseudocolumella and in any case attached to the inner surface of the endoperidium, sometimes undeveloped (paracapillitium). Exoperidium of simple or compound spines or of branny or scurfy particles, often caducous.

L. pratense Pers. emend. Quélet (=*L. hiemale* Vitt., *L. depressum* Bon.) (Fig. 4b)

Exoperidial spines compound, pale. Endoperidium ochraceous to buff or grey, areolate after fall of spines. Subgleba chambered, separated from gleba by a diaphragm confluent with the endoperidium. Gleba without pseudocolumella, Capillitium almost absent except at periphery of gleba where it is represented by a few straight, occasionally branched and occasionally septate hyphae without pits; paracapillitium of septate, hyaline hyphae; spores 3.5–5.5μ diam., almost smooth to finely spiny.

HABITAT: On the ground.

MATERIAL EXAMINED: KENYA: Verdcourt 3951, 12 miles S. of Mombasa, on path, coastal bush, 19.1.1964 (K). UGANDA: Calder 28, Makerere Hill, exposed mown sward, common after rain, 1964 (K). MAURITIUS: Telfair, Pouce Rouge, Jan. 1863 (K, as *L. gemmatum* var.).

NOTES: This species is recognizable by its diaphragm and capillitium. The latter seems to vary, according to the collection, from almost "mature" capillitium to completely collapsed, almost amorphous paracapillitium; most specimens fall between the two extremes, in fact most show considerable range within the same fruit-body. It is possible that African material will be separable into a number of taxa on capillitial and other characters when more collections are known. Large, caespitose, pyriform to obconical, dark-olivaceous specimens with purplish gleba are known from S. Africa, the Congo and Ghana under the name *L. djurense* sensu Bottomley and are probably specifically distinct.

Those species of *Lycoperdon* with a diaphragm are sometimes placed in a separate genus, *Vascellum* Smarda. Thus, this species is often called *V. pratense* (Pers.) Kreisel. On its own the diaphragm is perhaps insufficient as a generic distinction, and other characters, particularly the proportion of capillitium to paracapillitium, are variable. (See also Dissing & Lange, 1962.)

L. perlatum Pers. (Fig. 4d)

Sporocarp depressed to subturbinate. Pseudostem present. Exoperidium of closely grouped, usually simple warts, often so arranged that one large wart is surrounded by a ring of smaller ones, the

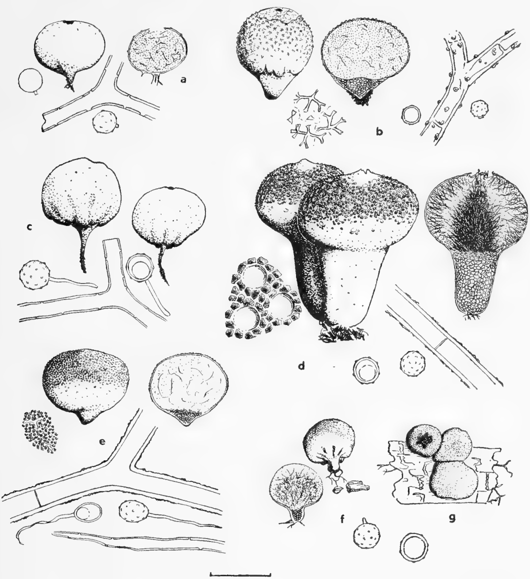

Fig. 4. *Lycoperdon*. a, *L. pusillum* habit and v.s. × ½, spores (on right as seen in air) and capillitium (BULLER); b, *L. pratense*, habit and v.s. × ½, details of exoperidium × 5, spores and Para capillitium (VERDCOURT 395); c, *L. citrinum*, habit × ½ (RAYNER 730, after watercolour by E. M. Rayner), spores and capillitium (MAITLAND 39); d, *L. perlatum*, habit and v.s. × ½, exoperidial details × 5, spores and capillitium (IRWIN 591); e, *L. asperum* sensu Dissing & Lange, habit and v.s. × ½, exoperidial details × 5, spores and capillitium (IRWIN 557); f-g, *L. fuliginium* sensu Dring, f, habit and v.s. × ½, spores (INGOLD), g, habit × ½ (RAYNER 720).

large central wart falling away to leave a marked areolus. Endoperidium buff or umber, dehiscing by an apical, raised, torn mouth. Subgleba grey-brown, of large well-marked chambers. Gleba olivaceous, with large pseudocolumella; capillitium of long threads, smooth, aseptate, sparingly dichotomous, with a few large and small pits in the walls; spores globose, 3.5–4.5μ, minutely warted.
HABITAT: On leaf litter, particularly in conifer plantations.
DISTRIBUTION: Widespread.
MATERIAL EXAMINED: KENYA: G. F. SCOTT ELLIOT, Ruwenzori Exp. 198, Yeria, Ruwenzori, 8–9,000 ft., May 1894 (BM); IRWIN 521, Endebess, Mt. Elgon (K); IRWIN 591 and 623, E. Mt. Elgon, cypress plantation, 1.6.1963 and 28.8.1963 (K).
NOTES: This is the common European species often called *L. gemmatum*. The material from Mt. Elgon is very close to *L. perlatum* var. *perlatum*, with spines near the top of the fruit-body distinctly divided into two sizes. In all the specimens the large spines have fallen, leaving a distinct areolus surrounded by small, simple, black spines. The spines on the lower part of the fruit-body, including the sterile base, are all small. The sterile base is well-developed and cylindrical in all the fruit-bodies, and the subgleba tan-coloured, large-chambered.

L. pusillum Batsch ex Schum. (? aggregate sp.) (Fig. 4a)

Sporocarp globose, up to about 2 cm. diam., sterile base absent, strong rooting strand or strands present. Exoperidium of fugaceous, mealy scales; endoperidium membranous, smooth, ochraceous, becoming brown with age, stoma plane, irregular. Gleba yellowish, becoming brown, pseudocolumella absent; capillitial threads honey-coloured to brown, aseptate or occasionally septate, freely branched, up to about 4μ diam., irregularly shaped, fragmenting, pits of varying diameter frequent in the walls; spores globose 3.5–5μ, very minutely verrucose, with the remains of a pedicel.
HABITAT: On the ground in exposed situations.
DISTRIBUTION: Cosmopolitan.
MATERIAL EXAMINED: UGANDA: MAITLAND 471, Entebbe, Bot. Garden, dunged flower bed, March 1919 (K). MALAWI: E. J. BULLER, Mlanje, Ruo Estate, under tea bushes, Feb.-March 1927 (K). RHODESIA: EYLES HERB. 7220, Salisbury, March 1932 (K).
NOTES: This widespread and common fungus needs little additional description. The spores of the E. African specimens appear smooth except when viewed in air-bubbles under oil-immersion.

There is a tendency for the spores to be sub-globose, slightly elongated along the axis of the pedicel. In MAITLAND 471 occasional spores have a longer pedicel than usual, up to twice as long as the spore.

L. citrinum Berk. & Br. (Fig. 4c)

Fruit-body globose to depressed globose, to 4 cm. diam., without sterile base or almost so, but with stout, branched, white rooting strand. Exoperidium of tiny warts, variable in colour but usually darker than the endoperidium, persistent. Endoperidium bright ochraceous, becoming umber with a metallic sheen. Gleba bright amber, becoming fulvous, without pseudocolumella; spores golden-yellow, globose, 3.5–5.5μ diam., smooth to just perceptibly (mounted in water, under oil-immersion) punctate, pedicel up to 20μ long; capillitium golden yellow, threads up to about 6μ diam., undulating, fragile when young, becoming more elastic in age, walls with minute pits difficult to see even under oil-immersion and often practically disappearing with age. Subgleba absent.
HABITAT: On the ground, very common on Kikuyu-grass lawns in Kenya.
DISTRIBUTION: Ceylon, southern tropical Africa.
MATERIAL EXAMINED: KENYA: IRWIN 557, E. Mt. Elgon, 8,000 ft., in *Cupressus macrocarpa* plantation (K). UGANDA: MAITLAND 39, Victoria Nyanza region [1914] (K, as *L. asperum* (Lév.) Speg.). S. RHODESIA: EYLES HERB. 7219, 7221, Salisbury, Feb.-March 1932, Dec. 1931 (K).
NOTES: This species is recognizable by the distinctive colour, by the configuration of the peridium and by the pedicellate spores. The Kenya material (Fig. 4c) is placed here only tentatively. It consists of a single fruit-body which differs from all the others in lacking a persistent rooting strand, its solitary habit, larger size, almost black exoperidial scales, ovoid spores, brown capillitium and compact subgleba. It corresponds almost exactly with the description and illustration given by Dissing & Lange (1962) for Congolese material attributed to *L. asperum* (Lév.) de Toni except that the spores are more narrowly ellipsoid, $4–5 \times 3–3.5\mu$. Kreisel (1964), however, says "*Lycoperdon citrinum* Berk & Br. 1873 = ? *L. asperum* sensu Dissing & Lange, 1962". We are not convinced that the Kenya material, at any rate, is either.

RAYNER 732, from Kenya (Shield's garden, Kiambu, on *Paspalum notatum* lawn, 5,600 ft., 3.12.1944) of which there is only a description, strongly suggests *L. capense* Cke. & Mass. The specimens must have resembled large (up to 8 cm. diam.) versions of *L. citrinum* in colour and habit. There is no type specimen of *L. capense* in Herb. K but it would seem from the description to be quite recognizable if found again. If it were rediscovered it would need renaming, Cooke and Massee's binominal being a later homonym of *L. capense* Fr.

An admirable, though brief, treatment of the puff-balls of the *pusillum* and *citrinum* group is given by Kreisel (1964). In this paper he places all those *Lycoperdon* in which the subgleba is absent or compact in the genus *Bovista*, reserving *Lycoperdon* for the more typical species with chambered subgleba. We have not, for the moment, accepted his line of demarkation between the two genera (see below).

L. fuligineum sensu Dring (1964) (Fig. 4f, g)

Sporocarp depressed globose to turbinate, occasionally umbonate, to 2.5 cm. diam., solitary to crowded, on rotten wood. Exoperidium fuscous above, usually lighter below, minutely granular, adherent to the endoperidium. Endoperidium pale chestnut, fragile, dehiscing by a torn apical stoma. Gleba amber; capillitium of hyaline, septate, often collapsed hyphae up to about 5μ diam., often grouped into fascicles (paracapillitium of Kreisel), spores globose, moderately to strongly echinnulate, 3–4 diam. Subgleba scanty to well developed, tan, minutely but definitely chambered, chambers to c. 0.25 mm. diam.
HABITAT: Rotten wood.
DISTRIBUTION: Ghana, São Tome, Kenya, Uganda.
MATERIAL EXAMINED: KENYA: B. F. Scott Elliot 145, Ruwenzori Exp. 1893–4, Ruwenzori 8,000 ft., May, in forest (BM); Rayner 729, Karura Forest, nr. Ruraka River 5,700 ft.; 2.12.1945 (K). UGANDA: C. T. Ingold, Upanda Forest, nr. Kampala, Spring 1963 (K).
NOTES: This is really a separate, probably undescribed, species in the *L. fuligineum* group. It differs from the type of that species in the presence of a chambered instead of a compact subgleba and in the more granular exoperidium.

The group as a whole forms a natural segregate from *Lycoperdon* which will be dealt with in another paper (Kreisel & Dring, 1967). It is characterized by lignicolous habit, by the dark colour and small size of the fruit-bodies, and by lack of true capillitium.

Bovista Dill. ex Pers.

Resembling the sessile Lycoperdons in a general way but with capillitium divided into separate elements with an obvious main axis, dichotomous at the ends and laterally branched, not having permanent connexion with the endoperidium nor confluent into a pseudocolumella.

Only one E. African record of *Bovista* is known to us. *B. membranacea* H. Lowag was originally described from Kilimanjaro. The type seems to have been lost but from the description it is clear that *B. membranacea* is a later synonym of *B. fusca* Lév. Yet another synonym of *B. fusca* is *B. umbrina* Bottomley, described from Natal. We are indebted to Dr. H. Kreisel for the above information.

The type material of *B. umbrina* in K (Rev. N. Roberts 5659, Woodbush, Jan. 1913) consists of a single fruit-body, subglobose, 2 cm. diam., with fulvous, granular, exoperidium worn away at the top to expose the greyish-sepia, metallic-looking endoperidium. Spores are dark brown, smooth, $5 \times 4\mu$, with a pedicel up to 15μ long; capillitium hyphae dark brown, to 13μ diam.

R.W.R. has observed a similar *Bovista* in the grounds of the French Mission, nr. Nairobi.

Calvatia Fr.

Sporocarp medium to large, with a strongly rooting sterile base. Exoperidium usually thin, occasionally of two layers, the outer one thick; endoperidium thin, the apical part breaking away in irregular patches to expose the gleba. Gleba copious; paracapillitium seemingly absent; subgleba ranging from small and dense to massive with very large chambers, often poorly differentiated from the gleba, even when the latter is mature at the top.

C. longicauda (Henn.) Lloyd (=*C. agaricoides* Dissing & Lange) (Fig. 5b)

Fruit-body extravagantly top-shaped to agaricoid, to about 8×8 cm., the flat- to concave-topped head abruptly differentiated from the stipe. Stipe sub-cylindrical, slightly tapering towards the base, $4–7 \times 1\frac{1}{2}–2$ cm. Exoperidium minutely velvety, the tomentum consisting of short columns of bladder-like cells, about 20μ diam., umber, adherent to endoperidium. Endoperidium very thin on drying, fragmenting and falling away. Gleba cinnamon buff to hazel, occasionally with a slight purplish tinge; capillitium of pale yellowish, slightly sinuous, much branched (at angles from about 60° to 120°) threads, often swollen at the frequent septa, about 3–4μ diam., pits absent; spores subglobose to ovoid or ellipsoid, $3.5–4.5 \times 4–4.5\mu$, minutely spiny, pale yellowish, with the persistent stump of a pedicel, often with a conspicuous oil-drop. Subgleba brown, chambers $\frac{1}{2}$–1 mm. diam.
HABITAT: In forest.
DISTRIBUTION: Cameroons, Congo, Uganda, Madagascar.

MATERIAL EXAMINED: UGANDA: MAITLAND 259, Entebbe, Botanic Gardens, on dry soil, April 1918; MAITLAND 260A, Entebbe, Botanic Gardens, on clay soil, April 1918; 260B, Busi, on leaf-mould, March 1919; 260C, Entebbe, in forests [no date].
NOTES: This species usually recognizable by its habit; less markedly agaricoid specimens are distinguishable from *C. gardneri* by the obviously chambered subgleba, umber rather than ochraceous peridium and irregularly branched capillitial hyphae which lack the large holes so characteristic of the capillitium of *C. gardneri* and its relatives. The gleba is much more persistent in this species than in the *C. gardneri* group. This is associated with the fact that the hyphae do not fragment nearly so readily, as is quickly noticed when one attempts to tease out the capillitum of both species in the course of making microscopic preparations.

C. subtomentosa Dissing & Lange (Fig. 6c)

Fruit-body shortly pyriform, with prominent sterile base, rooting by means of white strands. Exoperidium velvety, with slight tendency to form tufts, isabelline, splitting (with the endoperidium) into large scales and falling away from the upper part of the fruit-body. Gleba amber to fulvous, spores globose, 3.5–4.5μ diam., sparsely echinate, light yellow; capillitium hyphae 3–6μ diam., much branched, septate, fragmenting, though not necessarily at the septa, pits frequent, ranging from minute (just visible under oil immersion) to 4μ diam. Subgleba minutely and obscurely chambered, lighter in colour than the gleba.
HABITAT: On the ground in woodland.
DISTRIBUTION: The Congo, Kenya.
MATERIAL EXAMINED: KENYA: IRWIN 489, Endebess, Mt. Elgon, *Cupressus macrocarpa* plantation, Sept. 1962.
NOTES: The single fruit-body of this collection is placed here with slight hesitation because of its rather luxuriant exoperidium which cracks into large scales (c. 1 cm^2). This may be partly a reflection of the conditions under which it grew. In all other respects it agrees with the type specimen.

C. gardneri (Berk.) Lloyd (=*Lycoperdon gautieroides* Berk. & Br.) (Fig. 5a)

Sporocarp turbinate, to 10×10 cm., half the height being occupied by the sterile base. Exoperidium chestnut, minutely velvety below, tufted above, sometimes breaking into small scales. Endoperidium ochraceous, becoming rust colour above, paler below, brittle. Gleba ochraceous, fragile; capillitium of branched, septate, fairly straight, honey-coloured threads, to 7μ diam., usually c. 3μ, with occasional large pits in the walls; spores globose to subglobose, 3.5–5μ diam., slightly rough to minutely and sparsely spiny, concolorous with capillitium. Subgleba at first ochraceous, becoming brown, minutely and obscurely chambered.
HABITAT: On the ground.
DISTRIBUTION: Ceylon, Mauritius, E. Indies, tropical Africa.
MATERIAL EXAMINED: UGANDA: MAITLAND 259, Entebbe, Botanical Gardens, on clay soil, April 1918.
NOTES: This was originally a mixed collection, some of the fruit-bodies being referable to *C. longicauda* or they may have strayed into the packet from MAITLAND 260A.

In a previous paper (Dring, 1964) the spores of this species were described as being 5.5–7.5μ diam. This was an error; they are in fact much smaller 3.5–4.5μ in African material and $3.5–4.5 \times 4–5\mu$ in the type specimen from Ceylon.

The structure of the tufts of hyphae of the exoperidium is interesting. Microscopically they have a central core of elongated cells up to $5 \times 20\mu$ arranged in branched columns. This core is surrounded by rather shorter columns of much stouter cells about $15 \times 20\mu$. Unfortunately it was not possible to be completely satisfied about the microscopic structure of the exoperidium of the type material. Columns of both narrow and wide cells are present but whether they have the same arrangement in the tuft was not determined. However, in another specimen from Ceylon (PETCH 416, Peradeniya, May 1917 (K), the characteristic structure of the tuft was seen.

This species is very similar to *C. rubroflava* (Cragin) Lloyd. The differences are that the latter lacks the large sterile base, is perhaps generally more brightly coloured, stains yellow on bruising and has a shorter exoperidial tomentum. The spores are apparently always globose, whereas those of *C. gardneri* tend to be broadly ellipsoid, particularly in Asiatic specimens.

The capillitial hyphae of both species have the characteristic large holes in the walls, though in *C. rubroflava* they are much more variable in number and in size, resembling those of *C. subtomentosa*.

In all three species of this group (*C. subtomentosa*, *C. gardneri* and *C. rubroflava*) the capillitial hyphae tend to fragment at the weak places caused by these holes, rather than at the septa as occurs in the lilac-spored *Calvatias* (see below). The very persistent gleba of *C. longicauda* consists of hyphae without pits and which seldom break at the septa.

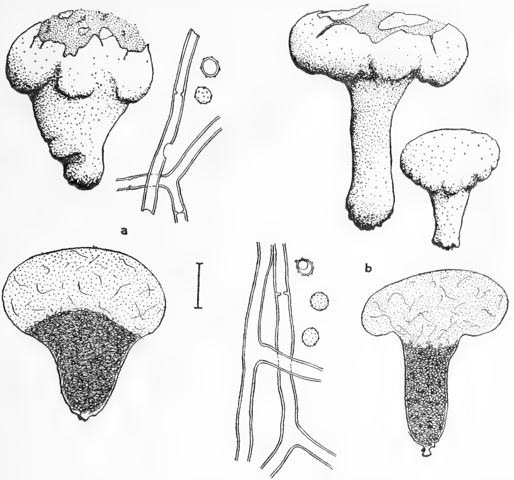

Fig. 5. *Calvatia*, p.p. a, *C. gardneri*, habit and v.s. × ½, spores and capillitium (MAITLAND 259); b, *C. longicauda*, habit and v.s. × ½, spores and capillitium (MAITLAND 260).

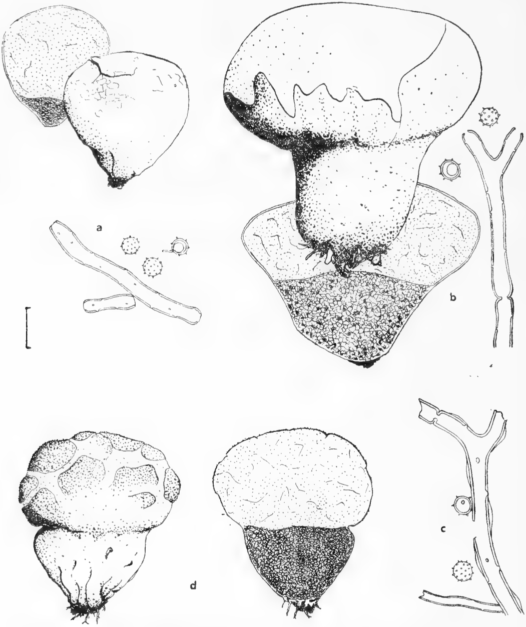

Fig. 6. *Calvatia* p.p. a, *C. cyathiformis* ssp. *fragilis*, habit and v.s. × ½, spores and capillitium (MAITLAND 48); b, *C. c.* ssp. *cyathiformis*, habit and v.s. × ½ (RAYNER 728, from watercolour by E. M. Rayner) spores and capillitium; c, *C. subtomentosa*, habit and v.s. × ½, spores and capillitium (IRWIN 489).

L. gautieroides Berk. & Br. is a synonym of *C. gardneri.* The type, from Ceylon, and many other collections in Herb. K, consists of small examples of *C. gardneri.* The type and PETCH 3241, Peradeniya, Oct. 1910 (K) appear to have been growing on or associated with rotten wood, notwithstanding that the original description specifies burnt earth as the substrate. It is evident from variant spellings in Berkely's manuscripts and the faint preposterousness of "gautieroides" that this is an error. The probable intention was "guatterioides" after the genus *Guatteria* (Annonaceae). Unfortunately the fungus does not resemble the fruit of *Guatteria* in the least though it might easily be taken for the fruit of an *Annona.*

C. cyathiformis (Bosc) Morgan

Sporocarp subglobose to pyriform, to 15 cm. diam., tapering abruptly to a crenulate sterile base. Exoperidium thin, continuous, smooth or floccose, whitish at first, later vinaceous buff, young specimens blackening on bruising. Endoperidium brown at maturity, thin, fragile, often becoming areolate, dehiscing by irregular cracking, often following the areolar margins. Gleba greyish purple; capillitium threads branched, septate, fragmenting, about the same diameter as the spores, with very frequent, minute pits in the walls; spores globose, 4–6μ diam., violaceous-brown, shortly pedicellate, moderately to strongly echinulate.

C. cyathiformis ssp. *cyathiformis* (=*C. lilacina* auctt.) (Fig. 6b)

Sporocarp large, sterile base large, usually marked-off from the fertile part by a constriction. Subgleba of moderately large chambers c. 0.5–1 mm. diam., rather ill-defined, spores usually strongly echinulate.
HABITAT: In grassy places where rainfall is high.
DISTRIBUTION: Widespread in the tropics and subtropics, N. America to Alberta, Ontario and Manitoba.
MATERIAL EXAMINED: UGANDA: C. B. USSHER, Mabira forest, June 1908; MAITLAND 261, Entebbe, Botanic Garden, on lawn, April 1918; and in front of Land Office, in pasture, Feb. 1919. KENYA: RAYNER 782, Kikuyu-grass, Vet. Labs., Kabete, 7,000 ft., 4.11.1946.
NOTES: This is recognizable by its large size, large sterile base with chambered subgleba and by the ornamentation of the spores.
For a discussion of the choice of the epithet "*cyathiformis*" see Dring, 1964.

C. cyathiformis ssp. *fragilis* (Vitt.) Dring (=*C. fragilis* Vitt. = *C. lilacina* (Mont. & Berk.) Henn.) (Fig. 6a)

Sporocarp medium sized to about 6 mm. diam., sterile base small, subgleba compact to minutely and obscurely chambered, occasionally with a few larger chambers near the base. Spores usually with small warts.
HABITAT: On the ground in open spaces.
DISTRIBUTION: Widespread in tropics and subtropics, N. America to Ontario, Central Europe.
MATERIAL EXAMINED: UGANDA: MAITLAND 48, Victoria Nyanza Region (K); MAITLAND 38, Mabira Forest, 1915 (K).
NOTES: Most of the African material (Dring, 1964), including MAITLAND 48, corresponds well with Vittadini's specimens of *Lycoperdon fragile* in K, except that the sterile bases tend to be larger in African collections. MAITLAND 38, however, has the long-spined spores more characteristic of ssp. *cyathiformis.*

Mycenastrum Desv.

Peridium woody, hygroscopic, typically dehiscing in an irregularly stellate manner. Capillitium of branched and spiny hyphae which are not attached to the peridium nor converging into a centra pseudocolumella.
The genus contains but one accepted species.

M. corium (Guersent) Desv. (Fig. 7b, c)

Fruit-body subglobose, medium-sized. Exoperidium single layered, thin and evanescent. Spores globose, 9–13μ, with irregularly reticulate ornament.
HABITAT: On the ground in dry places.
DISTRIBUTION: Widespread.
MATERIAL EXAMINED: KENYA: RAYNER, Limuru, c. 7,000 ft., bare ground in *Acacia* plantation; MRS. JOY BALLY, Isiolo. TANGANYIKA: H. E. DINGLE, Lake Manyara National Park. very dry ground under *Acacia*, Sept. 1962. UGANDA: WILSON 1333, Moroto, old kraal site.

Langermannia Rostk. (=Lanopila Fr.)

Sporocarps medium to large, globose or depressed globose, sterile base absent or vestigial, weakly rooting, usually becoming detached at maturity. Exoperidium thin, smooth to floccose, made up of a single layer. Endoperidium thin, fragile, falling away completely at maturity. Gleba copious; capillitium persisting as a free, more or less naked spongy mass after abscission of the peridium, consisting of branched, interwoven threads, spores globose, smooth to verrucose.

The genus has the same characters as *Calvatia* except for the lack of a significant sterile base, the habit of becoming detached from the ground, and the completely deciduous peridium. The capillitial hyphae do not fragment, unlike those of most *Calvatia* spp.

For a discussion of the synonymy used here see Dring (1964). A single species is recorded for E. Africa.

L. wahlbergii (Fr.) Dring (=*Lanopila wahlbergii* Fr.) (Fig. 7a)

Sporocarps to 15 cm. diam., globose to depressed globose, sterile base absent, weakly rooting. Peridium dirty white at first, becoming pinkish rust colour to hazel. Capillitium of septate hyphae, without pits, 2–5μ diam., pale brown, spores globose 5–7.5μ diam., brown, closely and strongly warted.
HABITAT: On the ground, free at maturity.
DISTRIBUTION: Africa south of the Sahara, tropical Asia.
MATERIAL EXAMINED: KENYA: J. McDonald, Rangai Forest, 6,000 ft., on ground in forest nursery, 22.11.1922 (K); Mrs. H. E. Brown, Rakrup Forest, on ground, common near elephant dung, which it resembles, 26.4.1964 (K); without data, via C.M.I. (K). UGANDA: Wilson 1332, Kadam Mt., 7,000 ft. (K, EA). TANGANYIKA: Braun 1949, Dodwe River, Amani, 16.2.1908 (EA, as *Lanopila bicolor*).

Geastrum Micheli ex Pers.

In this genus and its allies the exoperidium is well developed and dehisces radially from the apex, the resulting lobes bending back to give a stellate appearance to the mature fruit-body. The exoperidium consists of three layers, the outer mycelial, the middle fibrous and the inner fleshy. Tissue-tension between the two inner layers results in the rays being held at an angle more or less characteristic of the species. Some species are strongly hygroscopic, the rays being folded over the endoperidium when dry, spreading when wet, again due to tension between the two layers. The endoperidium, which is absent in a few species, dehisces by an apical pore. The characters of the peristome are important in distinguishing species.

G. velutinum (aggregate sp.) (Fig. 8a, b)

Unexpanded sporocarp globose or ovoid, top rounded or slightly umbonate, epigeal, attached to the substrate by a central, basal, radicating projection or occasionally a single, well-developed hyphal strand. Exoperidium saccate, split to about the middle into 5–8 expanded, broad, thick, subequal rays; fleshy layer flesh-coloured, becoming umber to dark umber when dry, moderately thick, adnate, usually cracking across the base of the rays to reveal the buff fibrous layer; mycelial layer thick, pliable, typically very finely felted-tomentose, buff-ochraceous, like very fine sand-paper to the touch, or sometimes more coarsely felted-tomentose, umber, but in any case almost free from debris, adnate or sometimes tending to bend away from the fibrous layer, especially at the points of the rays. Endoperidium smooth, sessile, globose to depressed globose, to 2 cm. diam., enclosed by the saccate base of the endoperidium; peristome broadly conical, fibrillose, depressed round the edge; concolorous or paler. Gleba umber, pseudocolumella cylindrical to spindle-shaped; spores globose 2.5–4μ diam., fuscous, minutely to finely, occasionally moderately, verrucose.
HABITAT: On the ground or rotting plant debris, in forest.
DISTRIBUTION: Widespread outside Europe.
MATERIAL EXAMINED: KENYA: P. J. Greenway, Muguga, in *Acacia* plantation (K). UGANDA: T. D. Maitland 81, Victoria Nyanza Reg. (K); Duemmer 1419, Kipango, 4,000 ft., on leaf-mould in forest (K); C. G. Hansford 2017, Masaka rd., mile 7, in forest (K); G. N. Calder 10, Mpangu, 4,300 ft., forest litter, 23.3.1964 (K); Calder 44, Mpangu, forest litter in light shade 13.4.1964 (K).
NOTES: This group is distinguished from *G. saccatum* by its usually larger size, harshly felted, usually paler, thicker, more pliable and continuous mycelial layer which often separates from the fibrous layer especially at the tips of the rays, and by its smaller, more finely verrucose, darker spores. Hansford 2017, Calder 44 and Duemmer 1419 have shortly tomentose, markedly "sand-papery", greyish ochre, separable mycelial layers. The remainder have a mycelial layer which is more orangy-ochre in colour, and the tangled hyphae of which tend to be woven together into loose bunches,

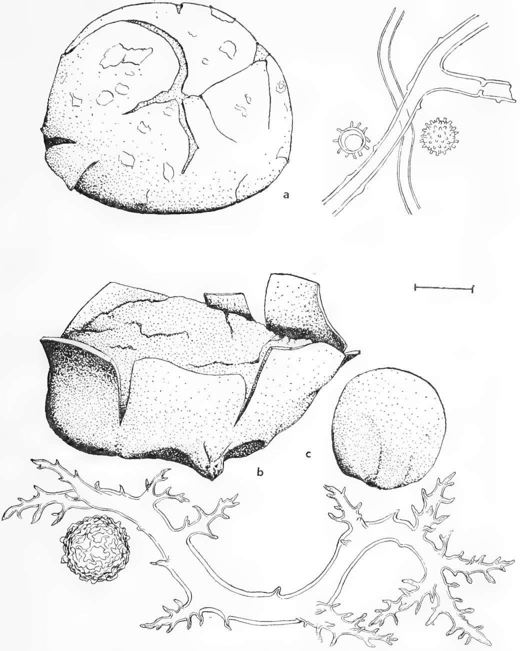

Fig. 7. Lycoperdaceae p.p. a, *Langermannia wahlbergii*, habit × ½, spores and capillitium (WILSON 1332); b-c, *Mycenastrum corium*: b, habit × ½, spore and capillitial element (WILSON 1333); c, habit, unexpanded, × ½ (BALLY 337).

often holding a little debris. There is less tendency for the mycelial layer to split away from the fibrous layer, and the fruit-bodies tend to be smaller, with more numerous and pointed rays.

There are other fairly well-marked forms of "velutinous" geasters, some of which have been given specific recognition, e.g. *G. scleroderma* Mont., and it is obvious that a thorough revision of the whole group is desirable.

G. schweinitzii (Berk. & Curt.) Zeller (=*G. mirabile* Mont.) (Fig. 8c)

Unexpanded sporocarps small, caespitose, obovoid, attached to a thick buff-coloured subiculum. Exoperidium deeply saccate, split into 5–7 unequal, short rays; fleshy layer flesh-coloured, drying brown, continuous or cracking across the base of the rays, adnate; mycelial layer buff, glabrous but in dried specimens minutely wrinkled. Endoperidium sessile 3–10 mm. diam., subglobose, dark brown, almost hidden in the saccate base of the exoperidium; peristome broadly conical, silky, concolorous or darker, marginally depressed. Gleba dark brown, spores 3–4μ diam., fuscous, minutely to finely verrucose.
HABITAT: On decaying wood, occasionally other plant debris, in forest.
DISTRIBUTION: Africa, America, Australia, Ceylon, Japan, Pacific Is.
MATERIAL EXAMINED: UGANDA: DUEMMER 1462, Kipayo, on log in forest (K); MAITLAND 291, Entebbe, in forest (K), HANSFORD 2017, Musaka rd., mile 7 (K). MAURITIUS: TELFAIR, ex Herb. W. Bojer (K, as *Lycoperdon pusillum*).
NOTES: This and a small group of similar species, is distinguished by the small size, crowded habit and growth from a subiculum on dead wood.

The type specimen of *Coilomyces schweinitzii* (K), though immature, is unmistakably conspecific with that of *G. mirabile* (P), and the earlier, though less familiar, epithet must be used.

HANSFORD 2017 was a mixed collection, mainly this species but with other fruit-bodies distributed in *G. saccatum* and *G. velutinum.*

G. saccatum Fr. (Fig. 8d, e)

Unexpanded sporocarp ovoid, umbonate, half-buried, attached by a bunch of hyphal strands which leave a prominent umbilical scar at the base of the sporocarp. Exoperidium splitting to about the middle into 5–7, occasionally up to 10, pliable, thin, subequal, acute rays which may become strongly revolute, or expanded, or remain at an angle of 45° to the vertical; fleshy layer pale rust colour to umber, adnate, frequently rimose; mycelial layer straw colour to ochraceous or rust colour, smooth, thin, radially and irregularly wrinkled at the base of the sporocarp, with adherent debris, flaking off in weathered specimens. Endoperidium sessile, 10–15 mm. diam., subglobose, glabrous, greyish-brown, usually partly enclosed by the saccate base of the exoperidium; peristome fibrillose; almost plane, concolorous with the rest of the endoperidium or paler, depressed at the periphery. Gleba umber; pseudocolumella indistinct, spores globose, 4–6μ, usually 4–5, moderately to strongly (occasionally finely) verrucose.
HABITAT: On soil or vegetable debris in damp places.
DISTRIBUTION: Widespread, frequent in warmer areas.
MATERIAL EXAMINED: KENYA: C. A. THOROLD 38, Elburgon, 8,000 ft., on soil in forest, July 1932 (K); VERDCOURT, Muguga, 1954 (K); A. FRENCH 8, Mpanya Forest, on ground in shelter of log, 30.3.1957 (K, with picture); IRWIN 592, E. Mt. Elgon, 30.5.1960 (K);. BALLY B12250, Nairobi, 5.5.1960 (K). UGANDA: DUEMMER 1424, Kipango, 4,000 ft., leaf mould in forest, April 1915 (K); HANSFORD 2017, Masaka rd., mile 7 (K).
NOTES: This species is often confused with *G. velutinum* to which it is not related. Fruit-bodies of *G. saccatum* tend to be smaller and the spores larger and lighter coloured. The mycelial layer is absolutely different, being thinner, rather dirty and smooth; in dried specimens it is thrown into characteristic wrinkles.

It is more difficult to distinguish between *G. saccatum* and *G. lageniforme* to which it is closely related and with which it is connected by a few intermediate forms. *G. saccatum*, however, has shorter wedge-shaped rays and a lighter, thicker often more fragile mycelial layer.

The East African sporocarps examined are all smaller and paler than is usual for the species. The mycelial layer is parchment coloured and lacks the characteristic cracks along the rays.

G. lageniforme Vitt. (Fig. 8h)

Unopened sporocarp ovoid with a strongly pointed apex, dehiscing when about 1.5 cm. broad. Exoperidium splitting to two-thirds or more of the way down into 5–8 (occasionally 10) subequal segments with long acuminate points; mycelial layer very thin, pale fulvous, entire; fleshy layer umber, adnate. Endoperidium sessile, 1–1.5 cm. diam., the base usually enclosed in the saccate

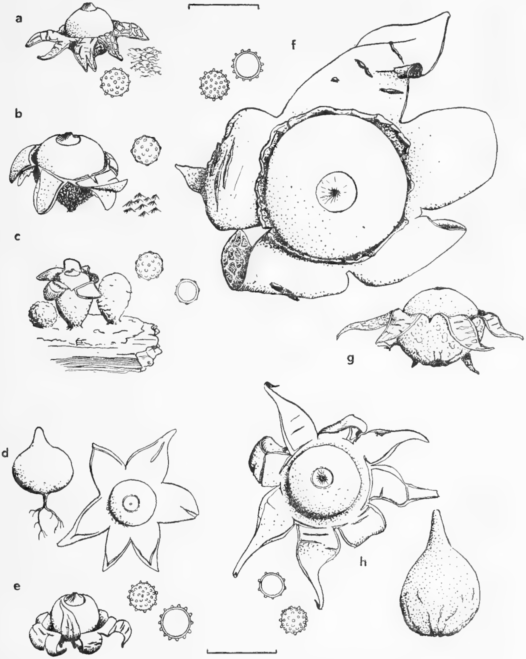

Fig. 8. *Geastrum* p.p. a, *G. velutinum*, felted form, habit × ½, mycelial layer × 5, spore (HANSFORD 2017); b, *G. velutinum*, velutinous form, habit × ½, mycelial layer × 5, spore (CALDER 4417); c, *G. schweinitzii*, habit × 2, spores (MAITLAND 291); d, *G. saccatum* habit, egg and expanded specimen, × ½ (from drawing by A. French); e, *G. saccatum* habit × ½, spores (VERDCOURT); f, *G. triplex*, habit × ½, spores (IRWIN 590); g, *G. triplex*, habit × ½ (RAYNER); h, *G. lageniforme*, habit, expanded specimen and egg, × ½, spores (BALLY 7404).

base of the exoperidium, umber; peristome fibrillose, often lighter than the surrounding endoperidium, conical, marginally depressed. Gleba umber, pseudocolumella clavate; capillitium up to 10μ diam., thick-walled, straw-coloured, often encrusted; spores globose, 3.5–4.5μ, pale to dark brown with regular or irregular, close, short, often flat-topped warts.
HABITAT: On soil or vegetable debris in damp places.
DISTRIBUTION: Cosmopolitan.
MATERIAL EXAMINED: KENYA: BALLY B7404, Lumbwa, Thiele-Winkler Estate, 7,300 ft., on forest floor, 12.9.1949 (K, EA).

G. triplex Junghuhn (Fig. 8f, g)

Unopened fruit-body 2 cm. diam., umbonate to pointed, with prominent basal mycelial tuft which falls away on drying to leave a marked scar. Exoperidium splitting to two-thirds of the way down into 5–8 broad, recurved or spreading rays; mycelial layer papery to leathery, pale umber, smooth to squamulose, peeling off in flakes in old specimens, debris-encrusted in patches; fibrous layer leathery, thin, persistent, buff to straw colour on the outside, darker inside; fleshy layer thick, buff to pale rust colour, drying sepia, cracking, particularly across the bases of the rays, the cracked edges tending to curve away from the fibrous layer. Endoperidium sessile, to about 1.5 cm. diam., globose to depressed globose, smooth, pale vinaceous grey to vinaceous buff; peristome broad, often barely defined, silky, usually darker than endoperidium; mouth usually broad with fimbriate margin. Gleba umber, pseudocolumella ovoid; capillitium about equal in diameter to the spores, pale to medium brown, tapering at the ends, often encrusted; spores globose, 4.5–6μ diam., regularly, closely and moderately to strongly warted, pale to dark brown.
HABITAT: On plant debris, etc., on the forest floor.
DISTRIBUTION: Cosmopolitan.
MATERIAL EXAMINED: KENYA: RAYNER, 5,500–6,000 ft., in *Acacia* forest; RAYNER 740, Limuru Distr., Rift Highlands, 7,000 ft. (K); IRWIN 590, E. Mt. Elgon, 8,000 ft., 26.5.1963 (K). TANGANYIKA: K. PIROZYNSKI M593, Kakombe, Kigoma, damp soil, 24.2.1964 (K).
NOTES: This species is distinguishable by the characteristic mode of cracking of the fleshy layer around the base of the rays to leave a "cup" enclosing the base of the endoperidium. This feature is not always present but is better seen in fresh than in dried specimens.

G. fornicatum (Huds. ex Pers.) Hook. (Fig. 9e)

Immature sporocarp subglobose, hypogeal. Exoperidium splitting to two-thirds of the way down into 4–5 rays, which bend backwards causing the mycelial layer to split away except at the tips of the rays and remain in the ground as a cup, whilst the other two layers become completely inverted, carrying the endoperidium upwards. Mycelial layer thickly coated with debris; fleshy layer often falling away in large patches. Endoperidium pedicellate, depressed globose, with an apophysis, hard, fuscous, minutely granular under the hand-lens; peristome silky, at first mammose and sub-definite, soon becoming indefinite and ragged, gleba brown vinaceous; capillitium threads brown, up to 15μ diam.; spores globose, finely verrucose, dark brown 3.5–5μ.
HABITAT: On humus under trees or shrubs.
DISTRIBUTION: S. Africa, Mauritius, Europe, Mediterranean region, N. and central America, Australia.
MATERIAL EXAMINED: MAURITIUS: H. BOLUS, without data, ex Herb. Berkeley (K, photograph only).
NOTES: The record consists of only a photograph but is certainly referable to this species. The description of the microscopic and colour details is drawn from other material at Kew.

G. dissimile Bottomley (Fig. 9f)

Resembling *G. fornicatum* except for the mouth characters. Peristome conical, sub-definite, not tearing readily but becoming radially folded though not truly sulcate.
MATERIAL EXAMINED: KENYA: E. A. HERB. 1167, Naivasha, Rongoni Forest, at roots of *Acacia* (K); RAYNER 739, Limuru, E. Rift Highlands, 1942–3 (K).
NOTES: This is accepted only provisionally as being specifically different from *G. fornicatum*. Rayner's specimens have had most of the peristome eaten by insects, but the little which remains seems to be of the *dissimile* type.

Contrary to Talbot's claim (in Bottomley, 1948, p. 604) we do not accept that there is any material difference between type material of *G. dissimile* and the collection in Herb K, labelled by Lloyd "*G. fornicatus* Huds. forma *macowani* Kalch" and presumably the same as the specimens described by him as *G. macowanii*. The real identity of *G. macowanii* is unknown. It resembled the European

form of *G. fornicatus* but was three times the size: it would have been a very large earth-star indeed. *G. dissimile*, however, is only about half the size of the European form. The peristome was, unhappily, missing from the type material of *G. macowanii* at the time when it was described.

G. drummondii Berk. (Fig. 9b)

Unexpanded fruit-body globose, epigeal, dehiscing when 1–2 cm. diam. Exoperidium splitting to the middle into 8–12 acute, subequal, strongly hygroscopic rays; fleshy layer sepia, adnate, continuous; mycelial layer thin, whitish, covered with debris, often becoming detached. Endoperidium sessile or (in dried specimens) occasionally shortly pedicellate, globose to depressed globose, up to 15 mm. diam., dirty white or, less frequently, umber, finely asperulate often becoming smooth with age; peristome boldly and regularly sulcate, often darker than the surrounding parts of the endoperidium. Gleba rust colour; spores globose, 4–6μ diam., moderately and irregularly verrucose, often briefly pedicellate.
HABITAT: On the ground in dry places.
MATERIAL EXAMINED: KENYA: VERDCOURT 638, Muguga on bare soil after rain, 16.4.1952 (K).
NOTES: The truely sulcate peristome distinguishes this species from those noted above and the hygroscopic nature of its rays separates it from the two following species.

Southern African specimens of *G. drummondii* differ from the type in a number of ways, notably in having a thinner fleshy layer and being less hygroscopic. They tend, in fact, towards the European and N. American *G. campestre*.

G. lloydianum Rick (Fig. 9c, d)

Expanded sporocarps to c. 5 cm. diam. Exoperidium splitting to about the middle into 9–13 narrow unequal acute rays, somewhat hygroscopic; mycelial layer externally encrusted with soil particles, floccose, white to buff, peeling off in sheets, particularly from the tips of the rays; fibrous layer straw colour to buff, thin; fleshy layer reddish brown, to about 1 mm. thick, drying fairly thin, continuous to rimose, often completely lacking in old specimens. Endoperidium globose to depressed globose, sessile, finely felted, mid- to pale umber; peristome concolourous or darker, sulcate. Gleba sepia, capillitial hyphae pale straw coloured, completely occluded, to 6μ diam.; spores dark brown, globose to irregular moderately and often irregularly warted, 3–5μ diam.
DISTRIBUTION: South and central America. Tropical Africa.
MATERIAL EXAMINED: ZAMBIA: ANGUS M313, Chilanga, nr. Mt. Makulu, 8.1.1957, on soil in woodland (K). MADAGASCAR: REV. R. BARON 5318, ?N.-W. Madagascar, 1887 (K).
NOTES: This species is distinguishable from *G. drummondii* by the much less strikingly and less regularly sulcate peristome, the almost smooth endoperidium, and the less hygroscopic rays with less persistent fleshy layer and flocculent mycelial layer.

G. nanum Pers. (=*G. schmidelii* Vitt.) (Fig. 9a)

Unopened fruit-body hypogeal to exposed. Exoperidium splitting to about the middle into about 5–8 unequal rays which become recurved; mycelial layer umber to sepia in the dried specimen, persistent, covered with a layer of debris; middle layer pale buff; fleshy layer adnate, entire or occasionally cracked. Endoperidium c. ½–1 cm. diam., ovoid to urn-shaped, often with a slight basal apophysis, shortly pedicellate in the dried specimen, light brown to greyish, the latter colour being due to a farina which covers the endoperidium of unweathered specimens, peristome sulcate, conical, concolorous with or darker than the rest of the endoperidium, surrounded by a groove. Gleba very dark brown, spores globose to subglobose, strongly and somewhat irregularly warted, 3–5.5μ diam., usually rather fuscous.
HABITAT: Woodland or open places.
DISTRIBUTION: Southern Africa, N. and S. America, Australia, India, Pakistan.
MATERIAL EXAMINED: KENYA: L. D. VERDCOURT, Muguga, Jan. 1956, abundant after rains on soil in woods, etc. (EA).
NOTES: Hennings (1902) records this species for the Usambaras as *G. schmidelii.*

Myriostoma Desv.

This genus resembles *Geastrum* but the spore sac dehisces by several pores and is supported on a number of pedicels. The gleba contains a number of pseudocolumellae. There is a single species.

M. coliforme (Dickson ex Pers.) Corda (Fig. 9i)

Unopened sporocarp to about 6 cm. diam. Exoperidium splitting to about halfway into 5–10 subequal triangular spreading or reflexed segments. Fleshy layer soon peeling off to expose the dirty white middle layer; mycelial layer thin, smooth, flaking off in a manner like that of *Geastrum triplex*. Endoperidium to 4 cm. diam., depressed globose, umber, becoming shining grey, coarsely roughened, with several pedicels and several naked stomata. Gleba with pseudocolumellae corresponding to the pedicels. Spores globose, 3–4μ diam., excluding the incompletely reticulate ornament which may be up to 2μ high; capillitium hyphae mostly about 4μ diam., coloured, branched, spirally twisted, thick-walled, with large crescentic pits in the walls, fragmenting at these pits, occasionally with large, spore-like swellings.
HABITAT: On the ground.
DISTRIBUTION: Cosmopolitan.
MATERIAL EXAMINED: KENYA: R.W.R's notes.
NOTES: The gleba is strikingly different from that of any other earth-star. The capillitial hyphae exhibit hygroscopic movements when first mounted on the slide, the rope-like strands uncoiling.
Microscopic data have been taken from S. African specimens in K, leg. MacOwan.

Astraeus Morgan

This genus differs from *Geastrum* principally in lacking a true hymenium at any stage of its development. This has been taken by many authors to imply that there is no close relationship between these genera and that any similarity is due to parallel evolution. *Astraeus* has thus been placed in a separate family. Partly for convenience, however, we have here included it in the Lycoperdaceae.

The single species resembles *Geastrum* macroscopically to a remarkable degree. There is, however, no pseudocolumella. Microscopically, the spores are much larger than those of most *Geastrum* species and the capillitium is unlike that of any *Geastrum*, being hyaline or nearly so, with swollen septa and modified clamp connexions, and strangely reminiscent of the capillitium of *Tulostoma*.

Astraeus hygrometricus (Pers.) Morg. (=*Geastrum hygrometricum* Pers.) (Fig. 9g,h)

Unopened fruit-body 4–6 cm. diam., subglobose. Exoperidium splitting to ¾ of the way down into 5–10 (occasionally more) acute, thick segments, strongly hygroscopic. Mycelial layer thin, scabrous, not persistent; middle layer hard, smooth brown; fleshy layer light umber or greyish becoming almost black with age, rimose. Endoperidium depressed globose, sessile, membranous, somewhat tomentose and marked with a network corresponding to the rimose cracking of the fleshy layer; mouth torn, indefinite; peristome indefinite. Gleba umber, capillitium threads to 8μ diam., branched, thick-walled, often collapsed, almost hyaline, swollen at the septa; spores globose, 6–10μ diam., strongly and very closely verrucose, brown, with the stump of a pedicel.
HABITAT: On the ground in woodland.
DISTRIBUTION: Worldwide.
MATERIAL EXAMINED: ZAMBIA: Angus m2615, nr. Chiwefwe Mine, nr. Mkushi Boma, soil in *Brachystegia* woodland, 8.4.1964 (K).

Broomeia Berk.

Sporocarps crowded together in groups of a few to about a thousand, each occupying a depression in the top of a common stroma, the whole said to be covered when young by a common exoperidium, opening to expose the individual endoperidia each of which dehisces by a single apical stoma.

This genus shares with the related, monotypic *Diplocystis* from Cuba the distinction amongst gasteromycetes of being stromatic. The affinities of *Broomeia* and *Diplocystis* are unknown; though they seem close to the Lycoperdaceae, and are here included in that family. Zeller (1949) has placed them, together with *Lycogalopsis*, which they scarcely resemble, in the Broomeaceae. A number of differences between *Broomeia* and more typical Lycoperdaceae are indicated below, but whether *Broomeia* is indeed a member of that family will remain uncertain until much more detailed studies have been carried out. This lack of knowledge extends particularly to the development of the fruit-bodies, but immature material, fresh or preserved in liquid preservative, would be necessary for such a study, and is not available.

The character of the exoperidium is usually given as the basis of generic distinction between *Broomeia* and *Diplocystis*. In *Diplocystis* each fruit-body is said to have its own exoperidium while in *Broomeia* a common exoperidium enshrouds the whole cluster of fruit-bodies although passing between them and being continuous with the walls of the alveoli. Such a generic distinction cannot, however, be logically justified at the moment for a variety of reasons.

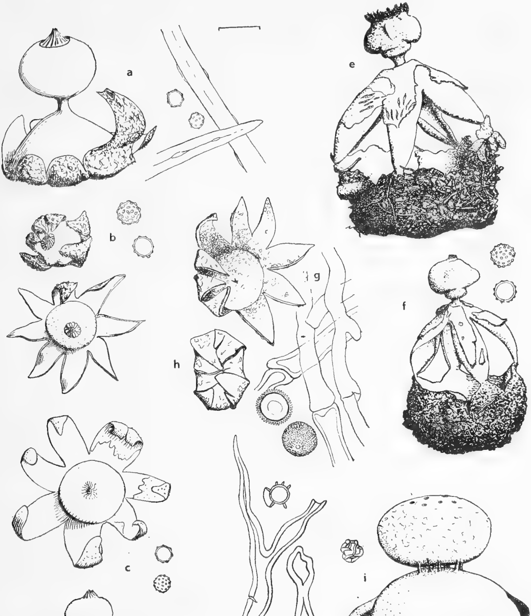

Fig. 9. Geastreae p.p. a, *Geastrum nanum*, habit × 2, spores and capillitium (VERDCOURT); b, *G. drummondii*, habit, dry and wet specimens × 1, spores (VERDCOURT); c, *G. lloydianum* habit × 1 and spores (ANGUS); d, *G. lloydianum*, habit × 1 (BARON); e, *G. fornicatum* habit × 1 (Mauritius, from photo); f, *G. dissimile* habit × 1, spores (E.A. HERB. 1167); g, *Astraeus hygrometricus* habit, wet specimen × 1, spores and capillitium (ANGUS); h, *A. hygrometricus* habit, dry specimen × 1 (Israeli material); i, *Myriostoma coliforme*, habit × ½, spores and capillitium (S. African material).

Dissing & Lange (1962) rightly refuse to assume that in *B. ellipsospora* the exoperidium does in fact cover the fruit-bodies before maturity as it does in *B. congregata*. The exoperidium has never been seen in *B. ellipsospora* or *D. wrightii*, and mature specimens betray not the slightest trace of ever having possessed such a membrane. In any case it is perhaps unjustifiable to call such a membrane an exoperidium; it is an extension of the stroma and its homology must be an object of doubt and study.

Finally, an exoperidium which covers each fruit-body separately cannot really be distinguished from one which is common to all, yet passes between each fruit-body and the next, and there becomes confluent with the rim of the alveolus in which each fruit-body is seated.

The real difference between the two genera lies in the alveolae themselves. In *Broomeia* the alveolae are purely depressions in the stromatic surface; in *Diplocystis* they are not truly alveolae at all but cups, each of which is separate and does not have a wall in common with its neighbours.

The two species of *Broomeia* are distinguished by the thickness of their stromata and the form of the spores.

B. congregata Berk. (Fig. 10d-f)

Sporocarps in clusters of up to a thousand, borne on a massive corky stroma, which is convex at the top. Spores subglobose to ovoid, 6–8.5μ in major diam., finely reticulate.
HABITAT: In dry areas, usually at the base of trees, often *Acacia*, on which it is probably parasitic.
DISTRIBUTION: S. Africa, S.W. Africa, Mozambique, Kenya, Nigeria.
MATERIAL EXAMINED: KENYA: RAYNER, Crater Lake, Naivasha, sandy soil nr. *Acacia xanthophloea* (K).
NOTES: This species has been recently described elsewhere (Bottomley, 1948; Dring, 1964) so only points of special interest, which are many, will be discussed here.

The spores are reticulate in the type (K), in Rayner's specimen and all the other collections to which we have had access. Reticulate spores are unknown in the Lycoperdaceae except in this species and a few species of *Disciseda* and *Abstoma*.

The gleba of *B. congregata*, though powdery at maturity, is very compact. Capillitial hyphae often pass directly through the groups of spores, becoming characteristically tortuous, presumably by pressure of the spores against them. Sections of slightly immature gleba show spores nestling in the bends of the capillitium threads.

The surface of the endoperidium is inconspicuously verrucose, as mentioned by Berkeley but overlooked subsequently. The curious microscopic structure of the warts is shown in Fig. 10e. They are usually subspherical to ovoid and most of them are only loosely attached to the endoperidium. In the next species, *B. ellipsosporus*, they are even better developed, whereas in *Diplocystis wrightii* the endoperidium is smooth. The endoperidial warts of *Geastrum drummondii* and related species are very different. They are cylindrical, firmly attached and consist of rather distorted, plate-like, hyaline cells.

The stroma consists of interwoven hyaline hyphae apparently of uniform structure throughout. However, the part immediately beneath the sporocarps is more compact, whereas the centre consists of looser tissue, eventually becoming hollow. (See Pole Evans & Bottomley, 1919, pl. xxi, for a photo of a fresh, hollow stroma.) Dried herbarium material therefore often consists only of the sporocarps plus the upper parts of the stroma, the basal attachment having broken off through the hollow centre. The structure of the mature stroma of *B. congregata* therefore approaches that of *B. ellipsospora*.

Fresh specimens are said to smell of aniseed, and the flesh of the fresh stroma is said to be red, resembling that of *Fistulina hepatica*. In herbarium material the red colour is limited to the compact upper layer of the stroma and is considerably less marked than in dried *F. hepatica*. Both the smell and the pigment are unique in the Lycoperdaceae.

B. ellipsospora v. Höhn. (=*Diplocystis junodii* Pole Evans & Bottomley) (Fig. 10a-c)

Sporocarps in clusters of up to 80 on a thin, saucer-shaped stroma. Spores ovoid, $6–8 \times 3.5–4.5\mu$, smooth or minutely roughened, sterigmatic scar visible at the broader end.
HABITAT: On sandy soil.
DISTRIBUTION: S. Africa, Mozambique, Angola, S.W. Africa.
MATERIAL EXAMINED: MOZAMBIQUE: REV. H. JUNOD, Rikatli, Lourenço Marques, 22.5.1919 (Cotype of *D. junodii*, K).
NOTES: The species has been well described by Bottomley (1948) and Dissing & Lange (1962), though the characteristically warted surface of the endoperidium is not mentioned in either paper nor in von Höhnel's original description. Macroscopically the warts are brownish and rather prominent but partly hidden by the floccose outer covering of the endoperidium. Both warts and flocci tend to wear off. In the case of the warts it is noticeable that their connexion with the underlying layer is tenuous, in fact their whole structure suggests that of sclerotia (Fig. 10b).

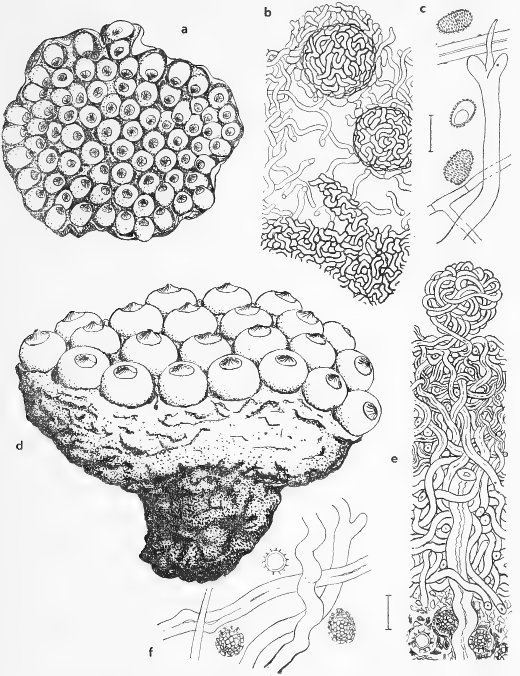

Fig. 10. *Broomeia*. a-c, *B. ellipsospora*: a, habit × 1; b, v.s. peridium; c, spores and capillitium (type of "*Diplocystis junodii*"); d-f, *B. congregata*: d, habit × 1; e, v.s. peridium Passing through a wart; f, spores and capillitium (RAYNER).

According to the descriptions the spores of the type collection and Dissing & Lange's (1962) collection from Angola are smooth. Bottomley describes the spores as smooth to rough. Those of the Lourenço Marques collection are minutely verrucose. The arrangement of the warts is rather difficult to see except when the spores are viewed in Melzer's iodine solution which shows up the ornament, though whether it reacts with it is difficult to establish.

The morphology of the stroma is described by Dissing & Lange (1962). As they state, there seems to be a "spurious" mycelial layer under the stroma and separate from it except, perhaps, at points directly under each fruit-body where the stroma protrudes downwards. The specimens at Kew give the impression that the space between the "mycelial layer" and the stroma is created by shrinkage of the tissues similar to that which occurs in *B. congregata*. Young stages have never been recorded, however, and one must in a genus so aberrant as *Broomeia*, accept such extrapolations only with extreme caution.

TULOSTOMATACEAE

This family, though very natural, is difficult to define in few words. Its members have a true stipe and a two-layered peridium, the outer layer of which encloses the immature fruit-body as a universal veil, splitting when the stipe elongates and then often remaining as a volva at the base of the stipe. The stipe is cleanly separable from the inner peridium of the head in one tribe, the Tulostomateae, confluent with it in the other, the Phellorineae.

The mature gleba is always powdery and lacks any suggestion of columella or pseudocolumella. Nevertheless, the constitution of the gleba differs in the two tribes. In the Phellorineae, the mature gleba is characterized by the persistence of the tramal plates and of fascicles of basidia. True capillitium is lacking, though the remains of the tramal plates may be mistaken for capillitial hyphae. In the Tulostomateae the gleba contains true capillitium and the tramal plates and basidial fasicles do not persist at maturity except in the transitional genera *Battarraea* and *Schizostoma*.

The mode of dehiscence of the inner peridium is very variable and is used as a criterion for distinguishing between genera.

Phellorinia Berk.

Sporocarp consisting of a subglobose head supported on a thick, solid woody stipe. Outer peridium covering both head and stipe, warted or scaly, tending to fall away. Inner peridium continuous with the stipe tissue, dehiscing by irregular rupture and erosion of the apical part. For an explanation of the nomenclature applied to the genus and its one accepted species, see Dring (1964).

P. herculeana (Pallas ex Pers.) Kreisel

Sporocarp to 10 cm. tall; head $3–5 \times 2–4$ cm.; stem $3–5 \times 1–2$ cm. Peridium cream coloured. Gleba rust colour, powdery, spores globose, 4.5–7μ diam., finely and closely warted, brown; capillitium absent but replaced by hyaline collapsed threads, aggregated into bundles, the remains of the tramal plates.

P. herculeana ssp. *herculeana* (=*P. inquians* auctt. non Berk.) (Fig. 11e)

The outer peridium consists of large inbricate scales and the head is usually ellipsoid rather than subglobose.
HABITAT: On the ground in dry, open places.
DISTRIBUTION: Africa, S. W. United States, Mediterranean region, central Europe, Australia.
MATERIAL EXAMINED: SOMALIA: Bally b9591, E. of Ghelinsor, 1,000 ft., open grassland, 5.4.1954 (K).
NOTES: In the young, fresh state there is no possibility of confounding this subspecies with the next, though in herbaria much confusion has occurred. The feathery, overlapping scales make this one of the most beautiful of gasteromycetes, but unfortunately they are slightly sticky and tear away or become compacted when the specimen is handled. A good photograph or drawing, made *in situ*, of a young specimen is much to be desired.

P. herculeana ssp. *strobilina* (Kalch.) Dring (=*P. inquians* Berk.) (Fig. 11d)

This differs from ssp. *herculeana* in that the outer peridium is very thick and splits into large zonate warts as maturity approaches. The habit is usually more squat than that of ssp. *herculeana*, the stipe being shorter and the head more rounded.
DISTRIBUTION: Africa, Asia, Australia.
MATERIAL EXAMINED: KENYA: Joy Adamson, nr. Lake Rudolph, Spring 1944 (K); Rayner 741, N. Frontier Distr., nr. Lake Rudolph, c. 1944 (probably part of the same coll., K).

Battarraea Pers.

Head concave below, convex above, firmly fixed to the stipe, dehiscing around the intersection of the two faces. Stipe long, scaly, hollow, with a well developed volva at the base.

B. stevenii (Liboschitz) Fr. (=*Sphaericeps lignipes* Welw. & Curr.) (Fig. 11h)

Immature sporocarp hypogeal, obovoid to obconical, enclosed in a universal veil. Head thrust above ground at maturity by elongation of the stipe. Stipe 10–50 cm. long, covered with coarse, imbricate scales, volva thick, woody, remaining below ground if stipe be pulled up. Gleba rust colour to sepia; capillitium of two types of hyphae, spirally or annularly thickened, elongated-fusoid threads, usually called "elaters" but constituting the capillitium proper, and collapsed, simple, hyaline threads bound together in fascicles, and really the remains of the trama (cf. paracapillitium); spores brown, subglobose, 4.5–6(–7)μ diam., seemingly finely truncate-verrucose.
HABITAT: Dry, sandy soil.
DISTRIBUTION: Mediterranean area, Hungary, U.S.S.R., Mongolia, Pakistan, the Americas, Africa, Australia.
MATERIAL EXAMINED: KENYA: RAYNER, nr. Lake Naivasha, sandy ground in *Acacia* woodland, May 1945 (K); BALLY B10537, Maji ya Chumvi, Coast Prov., 2,700 ft., in *Euphorbia* thicket on sandy soil, 13.5.1956 (K). SOCOTRA: PROF. BAYLEY BALFOUR 1300, 1345, and another collection without no., all collected Feb.-March, 1880 (all K).
NOTES: In addition to the above, this species has been recorded for Mozambique (Bottomley, 1948).

There is some doubt that *B. stevenii* is really separable from the European *B. phalloides*. The latter tends to be smaller, with a less scaly stipe, less persistent gleba (i.e. thinner tramal plates), more heavily and irregularly ornamented spores, and has a volva consisting of two membranous layers said to be separated by a gelatinous layer when fresh. Individuals from the same collection sometimes show a remarkable variation in the first three of these characters. In fact, whatever their geographical provenance, the larger individuals tend to have a more scaly stipe and more persistent gleba.

Spores of almost all the extra-European material of *Battarraea* in K are minutely and regularly ornamented, while the European material in K (almost all of which is English) has spores with just discernibly less regular and slightly stronger ornament.

Schizostoma Ehrenberg ex Léveillé

Mature sporocarp consisting of a relatively slender stipe fitting into a wide, shallow socket at the base of the head. Stipe hollow, woody, clearly differentiated from head but not cleanly separable from it as in *Tulostoma* and *Queletia*. Endoperidium dehiscing in a stellate manner. Universal veil forming a more or less well marked volva at the base of the stipe. Gleba consisting of true capillitium and subglobose, smooth spores.

S. laceratum Ehrenb. ex Lév. (Fig. 11f, g)

Sporocarps to about 6 cm. tall, stipe to 0.5 cm. diam., usually not markedly scaly; head pulvinate, to about 3 cm. diam., 2 cm. high, splitting into about 4–6 blunt major lobes. Volva usually reduced to a sand-encrusted swelling at the base of the stipe. Gleba ochraceous, becoming a dark, rich, reddish-brown (near vinaceous of Dade); capillitium of dark, thick-walled, and paler, thin-walled, collapsed hyphae, irregularly shaped, branched, fragmenting into short lengths at the septa, to 10μ diam., spores dark, irregularly globose, 3.5–6μ diam., absolutely smooth under oil-immersion, apiculate.
HABITAT: In semi-arid, sandy places.
DISTRIBUTION: Somalia, Sudan, Mali, Persia, W. Pakistan, Khazakstan, N. and S. America, Australia.
MATERIAL EXAMINED: SOMALIA: BALLY 3034, Burao, 26.1.1944, in sandy soil.
NOTES: The above specimen, and the description, refer to *S. laceratum* in the restricted sense. A number of authors consider *S. laceratum* to be the only valid species.

Tulostoma Pers.

Fruit-bodies stipitate, the subglobose head having a well-marked socket below, into which fits the slender, hollow, woody stipe and from which it may be broken away fairly readily and cleanly.

Outer peridium taking the form of a universal veil in the immature fruit-body, remaining in the adult as a more or less well marked basal volva and a collar round the socket, and sometimes continuing over the entire head, in which case it is warted. Endoperidium membranous, dehiscing by an apical stroma which may be indefinite or definite, and in the latter case tubular or more or less plane and with a definite peristome or without (in which case it is often called naked). Capillitium of branched and septate hyphae; spores globose to subglobose, smooth or variously ornamented.

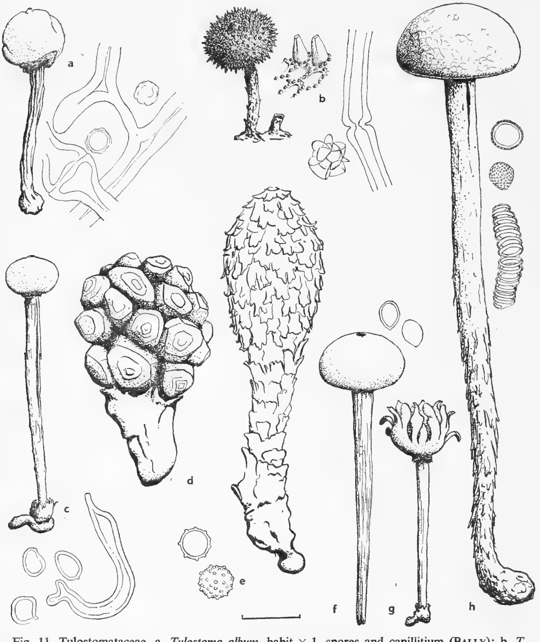

Fig. 11. Tulostomataceae. a, *Tulostoma album*, habit × 1, spores and capillitium (BALLY); b, *T. exasperatum*, habit × 1, peridial details × 5, spore and capillitium (GREENWAY); c, *T. volvulatum*, habit × 1, spores and capillitium; d, *Phellorinia herculeana* ssp. *strobilina*, habit × ½ (W. African material); e, *P. h.* ssp. *herculeana*, habit × ½, spores (W. African material); f, *Schizostoma laceratum*, young specimen without volva, habit × ½, spores (BALLY); g, *S. laceratum*, old specimen, habit × ½ (N. American material); h, *Battarraea stevenii*, habit, without volva and upper part of peridium, × ½, spores and elater (RAYNER).

T. volvulatum Borshchov (Fig. 11c)

Fruit-body usually 7–10 cm. tall, straw-colour throughout. Head depressed globose with plane, naked, circular to elliptical stroma and wide socket. Stipe scaly and longitudinally furrowed, with well marked volva at base. Gleba rust colour; spores subglobose to irregular, 4.5–5.5μ diam., smooth and apiculate; capillitium of irregular, short, branched hyphae.
HABITAT: Semi-arid ground.
DISTRIBUTION: Africa north of the Equator, Central Europe, Asia.
MATERIAL EXAMINED: BRITISH SOMALILAND: BALLY 7379, on rocky ground, 2.6.1949 (K). SOMALIA: BALLY 10401, Berbera-Behendulla road, on rocky ground 17.11.1954.

T. album Massee (Fig. 11a)

Head globose or depressed-globose, to about 2 cm. diam. Exoperidium impregnated with earth, cracking away late leaving a thick cup at the base. Endoperidium rosy-buff, minutely felted under the lens; mouth shortly tubular, elliptic; collar moderately wide. Stipe to 4 cm. × 3 mm., equal, or more usually attenuate downwards, with a well developed basal bulb, markedly striate, not scaly, concolorous with endoperidium to pale reddish brown. Gleba fuluous; capillitium hyaline, thick-walled to occluded, to c. 6μ diam., swollen and lightly pigmented at the septa; spores irregularly globose, 3.5–5μ diam., honey coloured, very irregularly and more or less prominently verrucose, the verrucae being hyaline.
HABITAT: On the ground.
DISTRIBUTION: Australia, Southern Africa.
MATERIAL EXAMINED: KENYA: BALLY 2627 [without data] (K).
NOTES: The material consists of a single sporocarp and is in some ways intermediate between *T. album* and *T. albicans* White. It is closely similar to J. P. H. Alcock's collection 403, from Kimberley (K), which Bottomley (1948) doubtfully ascribed to *T. albicans*. Both differ from the type specimen in having less prominently verrucose spores but these are certainly not smooth as in *T. albicans*.

T. exasperatum Montagne (Fig. 11b)

Sporocarps in groups on rotten wood. Head depressed globose, to about 1.5 cm. diam.; outer peridium very dark umber, of long and short spines, covering the head, wearing off late to leave an areolate surface reminiscent of that of *Lycoperdon perlatum*; inner peridium vinaceous; ostiole fimbriate, peristome definite, conical. Stipe to 5 cm. long, almost concolorous with peridial warts, with short, persistent, suberect scales. Gleba cinnamon buff, spores globose, very pale yellow, with deep hyaline ridges, 6.5–8.5μ diam., including ornament. Capillitium hyaline, branched, thick-walled, slightly swollen and not coloured at the frequent, perforated septa.
HABITAT: On rotten wood in forest.
DISTRIBUTION: Tropical Asia, tropical S. America, tropical Africa.
MATERIAL EXAMINED: TANGANYIKA: GREENWAY 5979, Msalai-Zaria, E. Usambara, 4,500 ft., 4.8.1940 (K, EA).
NOTES: This species is easily recognizable by the long (to 2 mm.) peridial spines. The ornamentation of the spores is also distinctive, and the habit of growing on wood in forest remarkable in the genus.

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(*Received for publication* 25*th May*, 1966)

BIRD RINGING FOR 1961—1966

By
J. SMART

The East Africa Natural History Society Bird Ringing Organization started ringing birds at the Eastleigh Sewage Works, Nairobi, in 1960. Brief reports have been published on the birds ringed up to the middle of 1961 (Blencowe, 1960 and 1962). This report covers all activities up to the middle of 1966.

Table I which is divided into two lists, palaearctic migrants and African birds, shows the total numbers of each species recorded as ringed on all ringing returns received to date. In most cases the returns cover the period to 30th June, 1966, but, Prof. D. A. Zimmerman's return up to August, 1966, has been included for the sake of completeness and because of the interesting species recorded. Several returns are still outstanding and those concerned who read this report are asked to send them in as soon as possible.

TABLE I

BIRDS RINGED BY THE EAST AFRICA NATURAL HISTORY SOCIETY BIRD RINGING ORGANIZATION UP TO 30th JUNE, 1966

Palaearctic Migrants (List 1)

1.	Ringed Plover. *Charadrius hiaticula* Linnaeus	1
2.	Mongolian Sand-Plover. *Charadrius mongolus* Pallas	1
3.	Great Sand-Plover. *Charadrius leschenaultii* Lesson	1
4.	Curlew Sandpiper. *Calidris testacea* (Pallas)	1
5.	Little Stint. *Calidris minuta* (Leisler)	122
6.	Ruff. *Philomachus pugnax* (Linnaeus)	38
7.	Common Sandpiper. *Tringa hypoleucos* Linnaeus	4
8.	Wood Sandpiper. *Tringa glareola* Linnaeus	8
9.	Marsh Sandpiper. *Tringa stagnatilis* (Bechstein)	9
10.	Greenshank. *Tringa nebularia* (Gunnerus)	1
11.	Grey Wagtail. *Motacilla cinerea* Tunstall	1
12.	Yellow Wagtails. *Budytes* species	722
13.	Spotted Flycatcher. *Muscicapa striata* (Pallas)	1
14.	Rock Thrush. *Monticola saxatilis* (Linnaeus)	1
15.	Wheatear. *Oenanthe oenanthe* (Linnaeus)	3
16.	Isabelline Wheatear. *Oenanthe isabellina* (Temminck & Langier)	1
17.	Sprosser. *Luscinia luscinia* (Linnaeus)	3
18.	Whitethroat. *Sylvia communis* Latham	2
19.	Garden Warbler. *Sylvia borin* (Boddaert)	23
20.	Blackcap. *Sylvia atricapilla* (Linnaeus)	7
21.	Upcher's Warbler. *Hippolais languida* (Hemprich & Ehrenberg)	2
22.	Olivaceous Warbler. *Hippolais pallida* (Hemprich & Ehrenberg)	4
23.	Great Reed Warbler. *Acrocephalus arundinaceus* (Linnaeus)	3
24.	Reed Warbler. *Acrocephalus scirpaceus* (Hermann)	14
25.	Sedge Warbler. *Acrocephalus schoenobaenus* (Linnaeus)	13
26.	Willow Warbler. *Phylloscopus trochilus* (Linnaeus)	6
27.	Swallow. *Hirundo rustica* Linnaeus	231
28.	Sand Martin. *Riparia riparia* (Linnaeus)	223
29.	House Martin. *Delichon urbica* (Linnaeus)	1
30.	Red-backed Shrike. *Lanius collurio* Linnaeus	4
31.	Red-tailed Shrike. *Lanius cristatus* Linnaeus	1
	TOTAL	1,452

African Birds (List 2)

1.	Sacred Ibis. *Threskiornis aethiopicus* (Latham)	7
2.	African Spoonbill. *Platalea alba* Scopoli	73
3.	Lesser Flamingo. *Phoeniconaias minor* (Geoffroy)	6
4.	Hottentot Teal. *Anas punctata* Burchell	1
5.	Quail. *Coturnix coturnix* (Linnaeus)	1
6.	Chestnut-banded Sand-Plover. *Charadrius venustus* Fischer & Reichenow	100

7.	Kittlitz's Sand-Plover. *Charadrius pecuarius* Temminck	3
8.	Blacksmith Plover. *Hoplopterus armatus* (Burchell)	6
9.	Avocet. *Recurvirostra avosetta* Linnaeus	1
10.	Tambourine Dove. *Tympanistria tympanistria* (Temminck & Knip)	5
11.	Emerald-spotted Wood-Dove. *Turtur chalcospilos* (Wagler)	2
12.	Pigmy Kingfisher. *Ispidina picta* (Boddaert)	4
13.	Grey-throated Barbet. *Gymnobucco bonapartei* Hartlaub	1
14.	Golden-rumped Tinker-bird. *Pogoniulus bilineatus* (Sundevall)	4
15.	Yellow-billed Barbet. *Trachylaemus purpuratus* (Verreaux)	2
16.	Buff-spotted Woodpecker. *Campethera nivosa* (Swainson)	1
17.	African Pied Wagtail. *Motacilla aguimp* Dumont	1
18.	Brown Illadopsis. *Malacocincla fulvescens* (Cassin)	7
19.	Pale-breasted Illadopsis. *Malacocincla rufipennis* (Sharpe)	13
20.	Scaly-breasted Illadopsis. *Malacocincla albipectus* (Reichenow)	21
21.	Mountain Illadopsis. *Malacocincla pyrrhopterus* (Reichenow & Neumann)	1
22.	Abyssinia Hill-Babbler. *Pseudoalcippe abyssinicus* (Ruppell)	3
23.	Dark-capped Bulbul. *Pycnonotus tricolor* (Hartlaub)	1
24.	White-vented Bulbul. *Pycnonotus barbatus* (Desfontaines)	1
25.	Bristle-Bill. *Bleda syndactyla* Swainson	7
26.	Brownbul. *Phyllastrephus terrestris* Swainson	7
27.	Northern Brownbul. *Phyllastrephus strepitans* (Reichenow)	2
28.	Smaller Yellow-streaked Greenbul. *Phyllastrephus debilis* (Sclater)	3
29.	Fischer's Greenbul. *Phyllastrephus fischeri* (Reichenow)	33
30.	Toro Olive Greenbul. *Phyllastrephus hypochloris* (Jackson)	5
31.	Olive-breasted Mountain-Greenbul. *Arizelocichla tephrolaema* (Gray)	15
32.	Shelley's Greenbul. *Arizelocichla masukuensis* (Shelley)	4
33.	Yellow-bellied Greenbul. *Chlorocichla flaviventris* (Smith)	4
34.	Zanzibar Sombre Greenbul. *Andropadus importunus* (Vieillot)	3
35.	Cameroon Sombre Greenbul. *Andropadus curvirostris* Cassin	14
36.	Little Greenbul. *Eurillas virens* (Cassin)	20
37.	Yellow-whiskered Greenbul. *Stelgidocichla latirostris* (Strickland)	195
38.	Ashy Flycatcher. *Alseonax cinereus* (Cassin)	2
39.	White-eyed Slaty Flycatcher. *Dioptrornis fischeri* Reichenow	4
40.	Puff-back Flycatcher. *Batis capensis* (Linnaeus)	2
41.	Black-throated Wattle-eye. *Platysteira peltata* Sundevall	8
42.	Chestnut Wattle-eye. *Dyaphorophyia castanea* (Fraser)	10
43.	Jameson's Wattle-eye. *Dyaphorophyia jamesoni* Sharpe	20
44.	White-tailed Crested Flycatcher. *Trochocercus albonotatus* Sharp	3
45.	Dusky Crested Flycatcher. *Trochocercus nigromitratus* (Reichenow)	13
46.	Paradise Flycatcher. *Tchitrea viridis* (Muller)	1
47.	Red-winged Paradise Flycatcher. *Tchitrea suahelica* (Reichenow)	3
48.	Black-headed Paradise Flycatcher. *Tchitrea nigriceps* (Hartlaub)	1
49.	Olive Thrush. *Turdus olivaceus* (Linnaeus)	15
50.	Abyssinian Ground-Thrush. *Geokichla piaggiae* (Bouvier)	1
51.	White-tailed Ant-Thrush. *Neocossyphus poensis* (Strickland)	1
52.	White-browed Robin-Chat. *Cossypha heuglini* Hartlaub	6
53.	Blue-shouldered Robin-Chat. *Cossypha cyanocampter* (Bonaparte)	7
54.	Red-capped Robin-Chat. *Cossypha natalensis* Smith	37
55.	Snowy-headed Robin-Chat. *Cossypha niveicapilla* (Lafresnaye)	2
56.	Robin-Chat. *Cossypha caffra* (Linnaeus)	6
57.	Equatorial Akalat. *Sheppardia aequatorialis* (Jackson)	29
58.	Brown-chested Alethe. *Alethe poliocephala* (Bonaparte)	27
59.	Eastern Bearded Scrub-Robin. *Erythropygia quadrivirgata* (Reichenow)	5
60.	White-starred Bush-Robin. *Pognocichla stellata* (Vieillot)	12
61.	African Reed Warbler. *Acrocephalus baeticatus* (Vieillot)	1
62.	Brown Woodland Warbler. *Seicercus umbrovirens* (Ruppell)	4
63.	Black-collared Apalis. *Apalis pulchra* Sharpe	2
64.	Grey-capped Warbler. *Eminia lepida* Hartlaub	1
65.	Olive-green Camaroptera. *Camaroptera chloronota* Reichenow	23
66.	Grey-backed Camaroptera. *Camaroptera brevicaudata* (Cretzschmar)	2
67.	Hunter's Cisticola. *Cisticola hunteri* Shelley	1
68.	Banded Prinia. *Prinia bairdii* (Cassin)	7
69.	Black-faced Rufous Warbler. *Bathmocercus rufus* (Reichenow)	22
70.	Angola Swallow. *Hirundo angolensis* Bocage	4
71.	African Sand Martin. *Riparia paludicola* (Vieillot)	2

72.	Square-tailed Drongo. *Dicrurus ludwigii* (Smith)	1
73.	Tropical Boubou. *Laniarius aethiopicus* (Gmelin)	7
74.	Violet-backed Starling. *Cinnyricinclus leucogaster* (Boddaert)	3
75.	Green White-eye. *Zosterops virens* Sundevall	2
76.	Kikuyu White-eye. *Zosterops kikuyuensis* Sharpe	2
77.	Bronze Sunbird. *Nectarinia kilimensis* Shelley	1
78.	Eastern Double-collared Sunbird. *Cinnyris mediocris* Shelley	2
79.	Olive Sunbird. *Cyanomitra olivacea* (Smith)	26
80.	Collared Sunbird. *Anthreptes collaris* (Vieillot)	3
81.	Green Hylia. *Hylia prasina* (Cassin)	4
82.	Dark-backed Weaver. *Symplectes bicolor* (Vieillot)	1
83.	Black-billed Weaver. *Heterhyphantes melanogaster* (Shelley)	4
84.	Reichenow's Weaver. *Othyphantes reichenowi* (Fischer)	8
85.	Grey-headed Negro-Finch. *Nigrita canicapilla* (Strickland)	2
86.	Red-headed Blue-Bill. *Spermophaga ruficapilla* (Shelley)	14
87.	Abyssinian Crimson-Wing. *Cryptospiza salvadorii* Reichenow	2
88.	Peter's Twin-Spot. *Hypargos niveoguttatus* (Peters)	1
89.	Purple Grenadier. *Granatina ianthinogaster* (Reichenow)	1
90.	Streaky Seed-Eater. *Serinus striolatus* (Ruppell)	1
91.	Thick-billed Seed-Eater. *Serinus burtoni* (Gray)	1
	TOTAL	947
	GRAND TOTAL, LISTS 1 AND 2	2,399

NOTE: The English and binomial names used in Table 1 are as used by Praed and Grant in their "Birds of Eastern and North Eastern Africa", 1952. In List 1 it should be noted that no attempt has been made to separate the population of Yellow Wagtails into the various forms which occur in Kenya. In List 2: African Birds, number 5, Quail is in fact *C. c. africana* Temminck & Schlegel the Cape Quail; and number 70, Angola Swallow is *H. a. arcticinta* Sharpe the Uganda Swallow. Binomials have been used in the Table for the sake of uniformity.

As far as is known all birds were caught in mist nets apart from the African Spoonbill pulli.

The bulk of the palaearctic migrants ringed belong to four species: Yellow Wagtails, Swallow, Sand Martin and Little Stint.

Most of the Yellow Wagtails were ringed by E. J. Blencowe and A. Carter in 1960 and 1961 at the Eastleigh Sewage Works, Nairobi. Although several birds were retrapped during the same winter, netting was not carried out for long enough over the second winter or in ensuing years to retrap birds after their long trip to their breeding grounds and back. In the 1960 to 1961 season ringing started on 19th November, 1960 and continued until 3rd April, 1961. Table II shows the number of Yellow Wagtails ringed each month and retrapping details.

TABLE II

NUMBER OF YELLOW WAGTAILS RINGED AND RETRAPPED AT EASTLEIGH SEWAGE WORKS, NAIROBI 1960/61

(1) Month	(2) Number ringed each month	(3) Months in which birds ringed in Column (2) were retrapped	(4) Number retrapped and expressed as a percentage of Column (2)		(5) Number retrapped each month and expressed as a percentage of Column (2)	
November, 1960	24	None retrapped	–	–	–	–
December, 1960	148	January to April, 1961	5	$3\frac{1}{2}\%$	–	–
January, 1961	195	January to March, 1961	4	2%	2	1%
February, 1961	67	None retrapped	–	–	2	3%
March, 1961	104	None retrapped	–	–	3	3%
April, 1961	48	None retrapped	–	–	2	4%

The retraps are too small in number to be evaluated reliably but it is noticeable that none of the birds ringed in November, February, March and April were retrapped, whereas the percentage of birds caught from January onwards which had been ringed in December and January rose steadily from a figure of 1% in January to 4% in April. The figures suggest a population change among the birds using the Eastleigh Sewage Works throughout the winter.

A further 131 Yellow Wagtails were netted and ringed at the Eastleigh Sewage Works in September and October, 1961 but this area has not been netted again between then and September, 1966.

On 7th March, 1964, 36 Yellow Wagtails were netted and ringed as they came into roost in tall elephant grass on the Ruiraka river near Nairobi. The birds dropped from a height into an area of low scrub before entering the elephant grass and it was here that the nets were set up. In late 1965 netting was attempted (unsuccessfully) adjacent to another roost in tall elephant grass at Kabete, the birds flying directly into the elephant grass. Later, this roost was visited at night to attempt to hand-pick sleeping birds off the grass, but they were roosting too high and were too easily disturbed.

On 6th November, 1965 one net was set up in a recently planted coffee plantation which was still largely open cultivated ground where Yellow Wagtails were found to flock before proceeding to a nearby roost. Nine birds were caught by driving and it was thought that many would be caught by driving if many nets were set up; however, when this was attempted on a later evening the birds completely avoided this cultivated area.

Experience has shown that Yellow Wagtails can most easily be netted at the Eastleigh Sewage Works during the daytime.

J. M. Lock has had two successful seasons netting Swallows and Sand Martins at Mweya in the Queen Elizabeth National Park, Uganda. He uses a flick-netting technique which was developed elsewhere. In this method a 60 foot tethered net is set up and fixed at one end only. the other end attached to a pole being held in the hand. He writes as follows (Lock, 1966, personal communication): "One pole must be either fastened to a tree, or else well pushed into the ground and guyed. The other pole is held horizontally by the operator. As the bird flies past the net is quickly jerked up, and *immediately lowered* to retain the bird if one is caught. The pole is then laid on the ground and the bird removed. Some practice is needed as it is not easy to judge the speed of the bird, and Swallows are extremely agile on the wing. Alternatively the net can be held at both ends, but this requires more practice and a great deal of co-ordination between the two operators.

It is very important to clear the ground below the net of all obstructions, pieces of grass, etc., which might catch in the net when it is laid down. The wind direction is important. Swallows using an area will feed slowly upwind. While doing this they are almost impossible to catch as they move too slowly and see the net. They are best caught as they sweep back downwind to the beginning of the feeding area. Flicking is best in a light wind."

Between 4th October, 1964 and 21st January, 1966 he succeeded in catching 210 Swallows, 156 Sand Martins and 1 House Martin. More interesting, three Swallows ringed in December, 1964 were retrapped in the same place in October and November, 1965. As far as is known these are the first birds to the ringed in East Africa and to be retrapped a year later after visiting Europe. This record emphasises the value of continued ringing activities over successive seasons and is an example of the fidelity of individual birds to a particular wintering area in Africa.

Little Stints have been ringed largely at Magadi by E. J. Blencowe in 1961 and at Manyara by A. M. Morgan-Davies in 1962 and 1966. No retraps have been reported so far. Unfortunately the 3.0 mm. rings supplied are not monel and may not have a long life in the brackish water frequented by these birds.

Although future ringing should probably best be concentrated on Swallows, Sand Martins and Yellow Wagtails which appear to be easiest to catch in large numbers and hence most likely to yield retraps, the ringing of single birds of a species is not necessarily unprofitable. The only Ringed Plover which was ringed (by S. M. Downhill at Mararani near the North Kenya coast on 29th August, 1962) was picked up in a sick condition and later died at Lindi on the South Tanzania coast four months later on 28th January, 1963, about 600 miles to the south.

The indiscriminate netting of small passerines by J. B. Smart around Nairobi in an attempt to catch migrants was not very successful and it is clear that the netting of migratory warblers is best attempted only during a passage migration, as was done successfully for a short time by D. J. Pearson from Kampala in April, 1966. An interesting catch at Athi River was an immature White-throated Robin *Irania gutturalis* (Guerin) which was not ringed.

Turning to the African birds, the bulk of these have been netted and ringed by Prof. D. A. Zimmerman during the course of his population studies in various forest areas, mainly at Kakamega, in 1965 and 1966. Mist nets were erected along narrow lines cut through the forest undergrowth with as little disturbance as possible, and were left up for several days before being moved, for as long as the catching rate stayed at a reasonable level. Nets placed parallel to and about 30 to 40 feet away from an open footpath had a greater catching rate than those at right angles to a footpath. D. A. Zimmerman first visited Kakamega forest in 1963 when he used American rings. Ringing details are not known but a number of retraps were made in 1965 and 1966 and East African rings substituted.

The 73 African Spoonbill were all ringed as pulli at a nesting colony on Lake Naivasha in June, 1962 by A. Smith.

The Chestnut-banded Sand-Plover were ringed at Magadi in 1961 by E. J. Blencowe and in 1964 by A. Smith. The rings may not have a long life as already explained.

The only Hottentot Teal reported as being ringed (in the Ngorongoro crater on 3rd June, 1964)

was shot at Lake Naivasha on 13th January, 1965, seven and a half months later and about 180 miles to the north.

The only African Pied Wagtail ringed (at Muguga in September, 1961) was caught again at the same place three years later and released. This bird had recently attempted to breed when first caught and can be presumed to have been at least four years old in 1964.

The Society has very little information on the recovery in East Africa of birds ringed abroad, and only two cases have come to the writer's attention although it is certain that more have occurred. If any additional cases are known to readers of this paper the Society would greatly appreciate the details which should be sent to the Director, National Museum, Nairobi.

An African Pochard *Aythya erythrophthalma* (Wied) ringed at Benoni in South Africa on December 6th, 1953 was shot in November, 1954 at Lake Naivasha about 1,800 miles to the north. (*Ostrich*, January 1956).

A Lesser Black-backed Gull *Larus fuscus* Linnaeus ringed at Pernaja Haveror in Finland on June 24th, 1961 was picked up at the Lake Rudolf Fishing Oasis on March 3rd, 1964 about 4,000 miles to the south. (*Africana*, June 1964.)

Although not directly the concern of the Bird Ringing Organization and although it has been recorded elsewhere by L. H. Brown, it is of interest to include here the recoveries of Lesser Flamingos ringed as juveniles at Magadi with B.T.O. rings in October/November 1962. Of the 8,000 birds ringed seven were found dead at Magadi in March, 1963 and two were found at Sodera on the river Awash in Ethiopia in July, 1964 about 800 miles to the north. (Brown, 1966, personal communication.)

Very little is known about the movements of birds within East Africa and about the movements of migrants to and from their breeding grounds in Europe and Asia.* In time bird ringing will provide this information provided that recoveries are fully reported. Anyone finding a dead bird with a ring on it may send the ring to the address stamped on it, but should preferably send the ring with a description of the bird and place and date found to the Director, National Museum, Nairobi, who will then inform the Ringing Organization concerned. In this way all available information can be recorded at the National Museum where it can be built up and be available for all those interested.

(*Revised 1st November 1966*)

*The author has overlooked the fact that recoveries of European-ringed birds have been published by Eggeling, W. J. *The Uganda Journal* **15:** 17—25 up to 1950. *Ed.*

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PRELIMINARY OBSERVATION ON THE EFFECT OF WATER FLOW ON PROTOZOAN POPULATION

By

APOLLO HEZEKIAH OGAMBO-ONGOMA

(*Department of Biology, West Virginia University, Morgantown, West Virginia, U.S.A.*)

INTRODUCTION

Provasoli (1958) has said, "The ecological arena is populated by the products of the continuous challenge of nature to the potentialities of the organisms." Protozoa are in close contact with their environment and should have a rapid and sensitive response to changes. Since one of the most striking variables in a lotic environment is the rate of flow, it was decided to see what effect two markedly differing rates had on the species composition of the protozona "community".

METHODS AND PROCEDURES

This experiment was done at the University of Michigan Biological Station, Pellston, Michigan. The lake water used was from Douglas Lake—the lake on whose shores the station is located.

Two troughs, 24″×2″×3″, made of galvanized iron were set up. They were arranged so that each was tilting at an angle of approximately 15°, so that water could flow through them. However, both ends of each trough were sealed so that water had to flow in, form a pool, and then overflow. Because of the tilting of the troughs, the pool was deep at the bottom ends and became progressively shallower as one approached the elevated ends. The whole experimental set-up was done in a building and hence irridescent light tubes were set up to provide the necessary radiant energy for photosynthesis. Four stones were collected from Douglas Lake beach, these were washed to get rid of organic matter that might harbour protozoans and two of the stones were put in each trough. The stones were to trap organic matter and hence get the Protozoan community to establish.

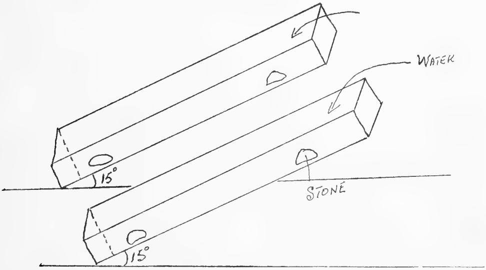


FIGURE I. Diagram to show trough arrangement.

TABLE I

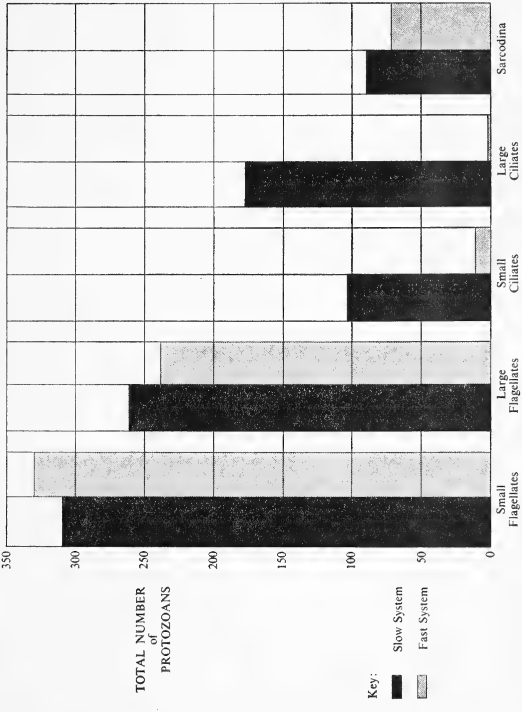
Slow System

Sample	Small flagellates	Large flagellates	Small ciliates	Large ciliates	Sarcodina
2 Days Elevated Area	3	Nil	1	Nil	Nil
Lower Area	4	1	2	Nil	1
6 Days Elevated Area	2	1	Nil	Nil	2
Lower Area	6	3	3	Nil	5
10 Days Elevated Area	26	23	1	1	3
Lower Area	30	7	4	4	7
13 Days Elevated Area	15	9	Nil	Nil	11
Lower Area	50	40	4	2	5
17 Days Elevated Area	23	5	2	10	16
Lower Area	66	57	9	7	5
20 Days Elevated Area	50	100	70	150	30
Lower Area	31	10	5	6	10
Total	306	256	101	180	95

Fast System

Sample	Small flagellates	Large flagellates	Small ciliates	Large ciliates	Sarcodina
2 Days Elevated Area	Nil	Nil	Nil	Nil	Nil
Lower Area	9	1	Nil	Nil	3
6 Days Elevated Area	Nil	Nil	Nil	Nil	Nil
Lower Area	11	7	1	Nil	5
10 Days Elevated Area	1	2	Nil	Nil	Nil
Lower Area	50	9	4	Nil	2
13 Days Elevated Area	2	3	Nil	Nil	Nil
Lower Area	70	52	3	1	11
17 Days Elevated Area	10	Nil	Nil	Nil	Nil
Lower Area	101	60	Nil	Nil	35
20 Days Elevated Area	4	2	Nil	Nil	Nil
Lower Area	70	102	1	Nil	15
Total	328	238	9	1	71

FIGURE 2


TOTAL NUMBER of PROTOZOANS
350
300
250
200
150
100
50
0
Small Flagellates
Large Flagellates
Small Ciliates
Large Ciliates
Sarcodina
Key:
Slow System
Fast System

Lake water was then pumped into the two troughs at two different rates.

1. In trough Number I referred to as the Slow System, water was run through at the rate of 4 ml. per second.
2. In trough Number II referred to as the Fast System, water was run through at the rate of 20 ml. per second.

The experiment was set up on July 18, 1966, and the first sampling done two days later; this was then carried out every Wednesday and Saturday of each week for three consecutive weeks. One drop of water containing organic matter constituted a sample and two samples were taken from each trough at each sampling. One of the two samples was taken from the pooled water in the area immediately around the stone in the elevated part of the trough. The second sample was taken from the pooled water in the lower area of the trough. Each time the samples were taken from the floor of each trough, and therefore contained as much of the organic sediments available as possible.

From these samples counts were made and five categories of protozoans were formulated as a basis for grouping and counting.

1. Small flagellate, e.g. members of the Orders Phytomonadina, Chrysomonadina, Protomonadina, and other "small-sized" flagellates.
2. Large flagellates, e.g. larger members of the orders Euglenoidina, Dinoflagellata, and other "large-sized" flagellates.
3. Small ciliates, e.g. members of the order Oligotricha.
4. Large ciliates, e.g. members of the orders Hymenostomata, Spirotricha, Holotricha and other "large-sized" ciliates.
5. Sarcodina.

   In order to give a more critical analysis of the results, it was necessary to divide the ciliates and flagellates into "small" and "large", since they occurred more often. This was not necessary for the Sarcodina and hence they were left as one group.

RESULTS AND DISCUSSION

Results are tabulated in Table I and presented graphically in Figure 2.

In course of experimentation, various things were noted:

1. In both systems, members of the Orders Phytomonadina, Protomonadina, and Chrysomonadina were first to establish themselves. Next to establish themselves were the larger flagellates such as members of the Orders Dinoflagellata and Euglenoidina. Next in sequence of population establishment were the Sarcodina, then smaller ciliates (such as members of the order Oligotricha) and lastly the larger ciliates, e.g. members of the Orders Spirotricha, Hymenostomata and Holotricha).
2. In the Slow System the protozoans were distributed from the lower area of the system right through to the elevated area. However, the lower portion of the system had a much higher concentration of protozoans. The Fast System on the other hand, had a very high concentration of protozoans in the lower area, but almost none in the elevated area of the System.
3. In the Slow System, there was a high concentration of ciliates almost evenly distributed throughout the system. On the contrary, the number of ciliates in all parts of the Fast System was almost negligible. See Table I for the actual counts and Figure 2 for graphic representation.

4. There was less organic sediment in the Slow System as compared to the Fast System. Distribution of the sediment was more even and increased gradually from the lower area to the elevated area of the system. On the other hand, in the Fast System organic sediment accumulated heavily in the lower area and almost none in the elevated area.
5. In the Slow System, whenever a dead crustacean or any small dead metazoan was found, there existed a high concentration of ciliates, especially the larger ones like hymenostomes, spirotrichs, and holotrichs. However, in the Fast System this concentration of ciliates never occurred even where dead metazoans were found. This sudden increase in number due to the dead metazoan may be noted in some counts shown in Table 2.

Seeing that there existed a significant variation in number of ciliates in the two systems: slow system—281 ciliates as compared to 10 ciliates in the fast system, yet both systems had everything equal except for variation in water flow, it was thought that water flow had something to do with this variation. It was therefore decided to reverse the rates of water flow and see what effect this would have. The slow system, had its water flow increased from 4 ml/second to 20 ml./second, and the fast system had its water flow decreased from 20 ml./second to 4 ml./second. Two days after this reversal sampling was done. As before, a drop of water containing organic matter constituted a sample and two samples taken from each system, in same areas as in the original set up. The second sampling was done 4 days, and the third and last one 7 days after the reversal. The population set up with regard to other groups of protozoans remained the same as before in the two systems, and hence no records of their counts were made. However, the ciliates were carefully counted and records made. The results of these counts are shown in Table II and graphical representation in Figure 3.

TABLE II

*"Slow System" (20 ml./second)	Small ciliates	Large ciliates	Total
1st Sample (2 days later). .	3	6	9
2nd Sample (4 days later). .	2	2	4
3rd Sample (7 days later) .	0	0	0
Total	5	8	13
*"Fast System" (4 ml./second)			
1st Sample (2 days later). .	0	0	0
2nd Sample (4 days later). .	4	2	8
3rd Sample (7 days later) .	13	84	97
Total	17	86	105

*These systems have reversed their water flow, however, to reduce confusion of nomenclature to the readers, the original titles are maintained even though the flow has changed. They are therefore put in quotation marks.

On reversal of water flow in the two systems it was noted that the ciliate population in the "slow" system declined very considerably while in the "fast" system no ciliates had established themselves after two days. Four days after the reversal, the "slow" system showed further decline while the "fast" system began to show some ciliates established. Seven days after the reversal, there was a high concentration of ciliates in the "fast" system while the "slow" system had been depleted very considerably of the ciliates.

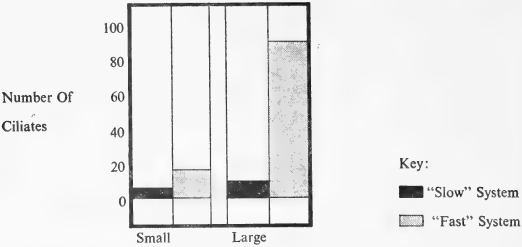


FIGURE 3. Graphic Representation of the New ciliate Population Set up.

It was also noted that where a small dead metazoan occurred, there was exceptionally high concentration of ciliates in the "fast" system while in the "slow" system, this concentration was not evident even where a dead metazoan occurred. This high concentration accounts for the sudden rise in one of the samples.

Results of this experiment were interpreted in the following manner:

1. The sequence in which species become established in the two systems conforms to the generally accepted relationship between "producers" and "consumers". However, exception to this occurred when some organic material (such as a dead metazoan) was introduced in the systems via the lake water.
2. Uniform distribution of organic sediment in the slow system in the original set-up is due to the slow current which allowed sedimentation to occur throughout the system. The fast system of this set up lacked organic sediment in the elevated area due to the swift water current that swept the organic sediments to the lower area before they had a chance to settle.
3. Sudden population increases in all groups in the Slow System on the 20th day is partly due to the presence of a dead metazoan in the system and secondly, in this system sedimentation of organic matter has been increasing gradually from the lower area to the elevated area of the system. Therefore as the organic sediments increases so does the population increase in the area. In this same slow system, the ciliate population tends to remain approximately the same in the lower area, and the increase seems to occur in the elevated area. This is due to the fact that most of the organic sediment was swept to the lower area, and the accumulation in the elevated area seems to be more gradual and hence, the population increases with increase in the amount of organic sediment.

Since all other factors were equal except for the rate of water flow in the two systems, it is apparent that ciliate population distribution was affected by the rate of water flow. This was confirmed when the set-up of the two systems was reversed as shown in Table II and Figure 3.

As to why many ciliates should not exist in a system with a high rate of water flow, it is possible that the reaction of ciliates to gravity has something to do with it.

Ciliates tend to be just below the surface film as a negative response to gravity. (Jennings 1906) established this fact during his work with *Paramecium caudatum*. (Kudo 1966: 157–164.) Since the ciliates remain just below the surface film, they were swept out of the system by the high water current before they had a chance to accumulate and reproduce and therefore establish themselves as part of the protozoan community.

It is therefore evident that under laboratory conditions, water flow affects protozoan population composition and that a high rate of flow more or less eliminates ciliates from the system. Even though this occurred under laboratory conditions, I have no reason not to believe that a similar phenomenon could occur in a stream or any other natural lotic environment.

ACKNOWLEDGEMENTS

Grateful acknowledgement is made to Dr. John Cairns, Jr., Professor of Zoology, University of Kansas under whose direction the research was done. My thanks to the University of Michigan at Ann Arbor for letting me use their facilities on Douglas Lake. I wish to thank Professor Arnold Benson, Dept. of Biology, West Virginia University for helping in the final correction and reading of the manuscript. I wish also to thank Dr. Albert G. Canaris, Professor of Zoology, Dr. Earl L. Core, Chairman, Dept. of Biology, and Dr. Robert Munn, Acting Dean of Graduate school, West Virginia University for making the necessary arrangements to enable me to be away from the Department while I was doing the Research. Lastly I wish to thank the Agency for International Development for providing the necessary finances while I was doing the work.

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(*Received 14th November, 1966*)

THE REEF HERON (*Egretta schistacea* Ehrenberg,) IN INTERIOR EAST AFRICA

By

Oscar T. Owre

That the Reef Heron is exclusively a bird of the marine littoral has been a long and firmly held impression. Archer & Godman (1937:51), for example, stated categorically that this heron "is confined to the sea-coast, appearing nowhere inland". More recent publications, by omission of reference to the accumulating inland records, have tended to perpetuate this impression. Mackworth-Praed & Grant (1957:46), although they had previously contributed to delineation of the species' inland range (see beyond), made no mention of this and Williams (1963) likewise omitted any comment as to occurrence inland.

Records from the interior of the Continent are widely distributed. Berlioz (1922:397 reported a specimen from Lac Abbay, Ethiopia. Chapin (1932:433) called attention to a specimen collected at Lake Albert by Sir Frederick Jackson in 1901. Grant & Mackworth-Praed (1933a:195) gave the range of this species in the interior of Africa as "up the Nile" and again (1933b:245), having examined the specimen referred to by Chapin (*loc. cit.*), revised the range to include distribution up the Nile as far as Lake Albert and they predicted that the heron would be found to occur all the way up the Nile to Lake Victoria. A specimen of the Reef Heron in the collections of the National Museum of Kenya, which had been collected at Lake Rudolf in March 1947, was cited by North (1966:231) who also gave a recent sight record at Lake Nakuru in May. Forbes-Watson (1966:233) reported that between the period July 1960 and October 1962, he had, on occasions, seen Reef Herons at Ferguson Gulf, Lake Rudolf.

Herewith are three additional records of the Reef Heron, all from Lake Rudolf. In 1958, as a member of the R. E. Maytag—University of Miami Expedition, I collected two specimens and made observations of a third. Pertinent data are:

a ♂, Dec. 1, Allia Bay, weight 638 grams
a ♀, Dec. 5, Allia Bay, weight 644 grams
a sight record, Nov. 9, El Molo Bay

The specimens are a part of the University of Miami Research Collections (UMRC). The male was examined by Dr. Dean Amadon of the American Museum of Natural History. He regarded it a subadult, judging by the amount of brown on the neck, the blackish back, and the lack of occipital plumes. The female resembles the adult grey phase plumage of the species; it lacks, however, plumes on either the back or head. The bird observed at El Molo Bay was similar to the latter, although it was not noted whether plumes were present or not. In these three birds, feathering of the chin, gular area, and anterior area of the jugulum was white. All were recorded as having yellow-orange mandibles, and the irides of the two specimens were yellow. The stomach of one bird contained a partly-digested *Tilapia*.

North (*loc. cit.*) regarded it "odd" that present Kenya records of the Reef Heron are from inland. The number of such records now at hand suggests that the species is of more than accidental occurrence in interior East Africa. Indeed, considering that ornithological observation at Lake Rudolf has been limited, the number of records now at hand from *this* area indicate that, at least in small numbers, the species is present there during a considerable portion of the year.

It is to be hoped that those concerned with future inland records of the Reef Heron will pay particular attention to certain kinds of information. The concept of polymorphism in birds has been elucidated only recently. It is evident that the "morphs" of a species—in the Reef Heron morphs being evidenced by colour or plumage phases—may vary proportionately within the species' range. Ratio-clines which thus exist suggest that the morphs may have differences in adaptability to the ecological situations. This is a consideration which has already received attention with respect to some reef herons (see, e.g. Thomson, 1964:658). The plumage patterns of inland visiting birds, therefore, should be noted in detail. At this time practically all of the records for which there is adequate information seem to be those of the grey morph or of those which appear to be intermediate between the grey and the white morph. The number of such records is probably still too small to be treated as significant and bias is no doubt inherent in the accumulation of this information, for white morphs which may occur inland are probably more easily overlooked by virtue of other white-plumaged herons. The record presented by Berlioz (*loc. cit.*) is apparently one instance of a white morph from inland. There are a number of plumages of the Reef Heron which are those of neither the typical grey nor the typical white morph. To what extent these are intermediate plumages (one assumes of hybrids between the morphs) or are attributable to age or seasonal change is not at this time at all clarified. Certainly these render difficult designation of birds observed in the field as immature or adult. Plumes, particularly occipital ones, should be looked for carefully.

The locality, both geographically and ecologically, should be described as accurately as possible. "Lake Rudolf", apparently the only notation as to the locality at which the specimen in the National Museum was taken, is hardly adequate. The three records herein contributed, from El Molo and Allia Bays, were all from areas of sandy, shallow shores, all three birds being encountered on narrow spits of sand. These situations were characterized by a sparsity of aquatic vegetation.

Observations of feeding behaviour are of interest. One of the herons I collected, the one incidentally with an empty stomach, was resting in shallow water on its tarsi, its yellow toes extended in front of it. The wings, barely spread, were drooped, their tips dangling in the water. During the half hour or so that I watched this heron from close range, it gave no outward indication of fishing. Its wing tips rocked gently at times by the ripples, its head slightly elevated above the horizontal, the bird gave the appearance of sunning or, at times, of being asleep.

Of much interest are sightings which may be indicative of route(s) the herons follow inland. Jackson's (1938:45) record from Witu, while only fifteen miles or so from the coast, suggests that feeding situations may originally attract birds away from the coast. One may hypothesize that to such birds, river valleys (in this case the Tana River Valley) or other features of the terrain might afford avenues inland. Amadon (*pers. com.*) regards the birds that ascend the Nile as immature or off-season wanderers. With respect to those Reef Herons which do come into the interior along this route, it is interesting to contemplate the fact that Lake Rudolf was formerly a part of the Nile system.

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(Received 2nd August 1966)

THE IDENTIFICATION OF ALOES IN EAST AFRICA

By
J. B. GILLETT

INTRODUCTION

Many readers of the *Journal of the East African Natural History Society* must, no doubt, be already acquainted with Dr. G. W. Reynolds' splendid book "The Aloes of Tropical Africa and Madagascar" which was published in 1966. Those who have tried to use it to identify Aloes in East Africa will probably have found Dr. Reynold's key to the groups into which he divides the genus difficult to follow and will have regretted the absence of any quick means of ascertaining which species have been found in any given area.

The present paper is an attempt to supply the latter desideratum and to provide a key, which, it is hoped, will be easier to use. It is in no sense an original work and is not based on any detailed study of the genus. It is merely an attempt to reorganize some of the information supplied by Dr. Reynolds so as to make it easier to use. Nobody should try to use the present paper by itself to name Aloes. It should be used simply as an adjunct to Dr. Reynolds' book and if it helps the reader to arrive more quickly at Dr. Reynolds' descriptions and illustrations, by reference to which alone can the naming of Aloes be carried out with any approach to confidence, the aim of the author will have been achieved.

In the table of geographical distribution the following areas are recognized.

WA is Tropical Africa west of the eastern boundary of the former British Cameroons.

CA, Central Africa, is the former French Equatorial Africa and former Belgian territory with Spanish and Portuguese enclaves. It is divided into X, the whole area except Rwanda-Burundi and R, Rwanda-Burundi.

NE, the North Eastern Area, is divided into SU, the Sudan Republic; ER, Eritrea; AR, Arabia; SC, Socotra; SM, Somalia and ET, Ethiopia apart from Eritrea.

EA, East Africa, consists of Uganda, Kenya and Tanzania, U 1–4, K 1–7 and T 1–9 are the provinces of these countries, as recognized in "The Flora of Tropical East Africa" T9 being the islands of Zanzibar and Pemba.

STA, South tropical Africa is divided into AN, Angola; ZA, Zambia; MA, Malawi, PE, Portuguese East Africa; RH, Rhodesia (Zimbabwe) and BO, Botswana (Bechuanaland protectorate).

SA is South Africa, together with South West Africa, Lesotho and Swaziland. In this column only those species are included which are known also to occur in one or more of the other areas.

In the final column a K indicates that the species is dealt with in the key.

Empty horizontal lines in the geographical table are used to separate the groups into which Dr. Reynolds divides the genus. These groups are *not* the same as those used in the present key to East African species.

The Key to East African species deals with all species known to occur in Rwanda-Burundi, Uganda, Kenya and Tanzania, together with additional species recorded from adjacent parts of neighbouring countries. The numbers of the species in the key are those used by Dr. Reynolds and can thus be used for quick reference to his work without the need to consult the index.

TABLE OF GEOGRAPHICAL DISTRIBUTION OF THE TROPICAL AFRICAN SPECIES OF *ALOE*

		WA	CA	NE	EA			STA	SA		
				SEASSE	U	K	T	AZMPRB			
			XR	URRCMT	1234	1234567	123456789	NAAEHO			
1	myriacantha	.	.x	......	.x..	..xx.x.	xx...xx..	..x.x.	x	1	K
2	ballii	.	..	......	....	....	....	....x.	.	2	
3	torrei	.	..	......	....	....	....	...x..	.	3	
4	plowesii	.	..	......	....	....	....	...xx.	.	4	
5	howmanii	.	..	......	....	....	....	....x.	.	5	
6	wildii	.	..	......	....	....	....	...xx.	.	6	
7	musapana	.	..	......	....	....	....	....x.	.	7	
8	inyangensis	.	..	......	....	....	....	....x.	.	8	
9	hazeliana	.	..	......	....	....	....	...xx.	.	9	
10	rhodesiana	.	..	......	....	....	....	...xx.	.	10	
11	buchanahii	.	..	......	....	....	....	..x...	.	11	
12	nuttii	.	x.	......	....	....	...x..x..	xxx...	.	12	K

"The Aloes of Tropical Africa and Madagascar" *by* G. W. Reynolds (1966). *Obtainable from:* The Aloes Book Fund, Box 234, Mbabane, Swaziland. Price Shs. 98/-.

		WA	CA	NE		EA		STA	SA		
				SEASSE	U	K	T	AZMPRB			
			XR	URRCMT	1234	1234567	123456789	NAAEHO			
13	richardsiae	.	..	......	....	....	......x..	......	.	13	K
14	bullockii	.	..	......	....	....	...x.....	......	.	14	K
15	buettneri	x	x.	......	....	....	....	xxx...	.	15	
16	jucunda	.	..	....x.	....	....	....	......	.	16	
17	hemmingii	.	..	....x.	....	....	....	......	.	17	
18	jacksonii	.	..	x	....	....	....	......	.	18	K
19	somaliensis	.	..	....x.	....	....	....	......	.	19	
20	erensii	.	..	x.....	....	.x.....	....	......	.	20	K
21	peckii	.	..	....x.	....	....	....	......	.	21	
22	mcloughlinii	.	..	x	....	....	....	......	.	22	
23	pirottae	.	..	xx	....	x..x..x	....	......	.	23	K
24	dorotheae	.	..	......	....	....	..x......	......	.	24	K
25	morogoroensis	.	..	......	....	....	.....x...	......	.	25	K
26	greenwayi	.	..	......	....	....	..x......	......	.	26	K
27	amudatensis	.	..	......	x...	xx.....	....	......	.	27	K
28	graminicola	.	..	x	....	..xx...	....	......	.	28	K
29	kilifiensis	.	..	......	....	x	....	......	.	29	K
30	greatheadii	.	x.	......	....	....	....	.x.xxx	.	30	
31	swynnertonii	.	..	......	....	....	....	..xxx.	.	31	
32	duckeri	.	..	......	....	....	......x..	.xx...	.	32	K
33	saponaria	.	..	......	....	....	....	....x.	x	33	
34	zebrina	.	..	......	....	....	....	xxxxxx	x	34	
35	macrocarpa	x	..	xx...x	....	....	....	......	.	35	
36	lateritia	.	xx	......	...x	..xx.xx	.xx...xx.	......	.	36	K
37	hereroensis	.	..	......	....	....	....	x.....	x	37	
38	chabaudii	.	x.	......	....	....	......xx.	.xxxx.	x	38	K
39	bukobana	.	..	......	....	....	x..x.....	......	.	39	K
40	milne-redheadii	.	..	......	....	....	....	xx....	.	40	
41	mzimbana	.	x.	......	....	....	...x.....	.xx...	.	41	K
42	rivae	.	..	x	....	x......	....	......	.	42	K
43	grata	.	..	......	....	....	....	x.....	.	43	
44	niebuhriana	.	..	..x...	....	....	....	......	.	44	
45	rigens	.	..	....x.	....	....	....	......	.	45	
46	tomentosa	.	..	..x.x.	....	....	....	......	.	46	
47	doei	.	..	..x...	....	....	....	......	.	47	
48	trichosantha	.	..	.x...x	....	....	....	......	.	48	
49	menachensis	.	..	..x...	....	....	....	......	.	49	
50	pubescens	.	..	x	....	....	....	......	.	50	
51	eremophila	.	..	..x...	....	....	....	......	.	51	
52	serriyensis	.	..	..x...	....	....	....	......	.	52	
53	dhalensis	.	..	..x...	....	....	....	......	.	53	
54	audhalica	.	..	..x...	....	....	....	......	.	54	
55	barbadensis	.	..	..x...	....	....	....	......	.	55	
56	metallica	.	..	......	....	....	....	x.....	.	56	
57	massawana	.	..	.x....	....	....	.....?...	......	.	57	K
58	vacillans	.	..	..x...	....	....	....	......	.	58	
59	officinalis	.	..	..x...	....	....	....	......	.	59	
60	otallensis	.	..	x	....	x......	....	......	.	60	K
61	splendens	.	..	..x...	....	....	....	......	.	61	
62	cremnophila	.	..	....x.	....	....	....	......	.	62	
63	pendens	.	..	..x...	....	....	....	......	.	63	
64	confusa	.	..	......	....	....	.x.......	......	.	64	K
65	veseyi	.	..	......	....	....	...x.....	.x....	.	65	K
66	mendesii	.	..	......	....	....	....	x.....	.	66	
67	penduliflora	.	..	......	....	....	........?	......	.	67	K

		WA	CA XR	NE SEASSE URRCMT	U 1234	EA K 1234567	T 123456789	STA AZMPRB NAAEHO	SA		
68	venusta	.	..	......	....	....	...x.....	......	.	68	K
69	macrosiphon	.	.x	......	.x..	....	x........	......	.	69	K
70	compacta	.	..	......	....	....	...x.....	......	.	70	K
71	cryptopoda	.	..	......	....	....	....	.xxxxx	x	71	
72	crassipes	.	x.	x.....	....	....	....	.x....	.	72	K
73	christianii	.	x.	......	....	....	x..x..xx.	xxxxx.	.	73	K
74	pretoriensis	.	..	......	....	....	....	....x.	x	74	
75	forbesii	.	..	...x..	....	....	....	......	.	75	
76	perryi	.	..	...x..	....	....	....	......	.	76	
77	scobinifolia	.	..	....x.	....	....	....	......	.	77	
78	sinkatana	.	..	x.....	....	....	....	......	.	78	
79	elegans	.	..	.x...x	....	....	....	......	.	79	
80	wrefordii	.	..	x	x...	....	....	......	.	80	K
81	sinana	.	..	x	....	....	....	......	.	81	
82	camperi	.	..	.x...x	....	....	....	......	.	82	
83	adigratana	.	..	x	....	....	....	......	.	83	
84	calidophila	.	..	x	....	x......	....	......	.	84	K
85	inermis	.	..	..x.x.	....	....	....	......	.	85	
86	globuligemma	.	..	......	....	....	....	xx	x	86	
87	turkanensis	.	..	......	x...	xx.....	....	......	.	87	K
88	leachii	.	..	......	....	....	.....x...	......	.	88	K
89	guerrai	.	..	......	....	....	....	x.....	.	89	
90	secundiflora	.	..	x....x	....	x.xx.xx	xxxxx.x..	......	.	90	K
91	ortholopha	.	..	......	....	....	....	....x.	.	91	
92	mawii	.	..	......	....	....	.......x.	..xx..	.	92	K
93	aculeata	.	..	......	....	....	....	....x.	x	93	
94	rubroviolacea	.	..	..x...	....	....	....	......	.	94	
95	decurva	.	..	......	....	....	....	...x..	.	95	
96	lavranosii	.	..	..x...	....	....	....	......	.	96	
97	ruspoliana	.	..	xx	....	x.....x	....	......	.	97	K
98	classenii	.	..	......	....	x	....	......	.	98	K
99	sereti	.	x.	......	....	....	....	......	.	99	K
100	mubendiensis	.	..	......	...x	....	....	......	.	100	K
101	wilsonii	.	..	......	x.x.	....	....	......	.	101	K
102	ukambensis	.	..	......	....	...x...	....	......	.	102	K
103	breviscapa	.	..	....x.	....	....	....	......	.	103	
104	tweediae	.	..	x	....	x......	....	......	.	104	K
105	percrassa	.	..	.x...x	....	....	....	......	.	105	
106	harlana	.	..	x	....	....	....	......	.	106	
107	steudneri	.	..	.x...x	....	....	....	......	.	107	
108	berhana	.	..	x	....	....	....	......	.	108	
109	monticola	.	..	x	....	....	....	......	.	109	
110	schelpei	.	..	x	....	....	....	......	.	110	
111	keayi	x	..	......	....	....	....	......	.	111	
112	schweinfurthii	x	x.	x.....	x...	....	....	......	.	112	K
113	megalacantha	.	..	xx	....	....	....	......	.	113	
114	macleayi	.	..	x.....	....	....	....	......	.	114	K
115	microdonta	.	..	....x.	....	....	....	......	.	115	K
116	marsabitensis	.	..	x.....	x...	x......	....	......	.	116	K
117	medishiana	.	..	....x.	....	....	....	......	.	117	
118	gracilicaulis	.	..	....x.	....	....	....	......	.	118	
119	angolensis	.	..	......	....	....	....	x.....	.	119	
120	gillilandii	.	..	..x...	....	....	....	......	.	120	
121	excelsa	.	..	......	....	....	....	.xxxx.	.	121	
122	littoralis	.	..	......	....	....	....	xx.xxx	x	122	

		WA	CA XR	NE SEASSE URRCMT	U 1234	EA K 1234567	T 123456789	STA AZMPRB NAAEHO	SA		
123	munchii	.	..	......	....	....	....	...xx.	.	123	
124	rupicola	.	..	......	....	....	....	x.....	.	124	
125	ballyi	.	..	......	....	...x..x	.xx......	......	.	125	K
126	volkensii	.	.x	......	.x..	...x...	xxx.....?	......	.	126	K
127	squarrosa	.	..	...x..	....	....	....	......	.	127	
128	zanzibarica	.	..	......	....	....	........?	......	.	128	K
129	tororoana	.	..	......	..x.	....	....	......	.	129	K
130	hendrickxii	.	x.	......	....	....	....	......	.	130	K
131	deserti	.	..	......	....	...x..x	..x......	......	.	131	K
132	hildebrandtii	.	..	....x.	....	....	....	......	.	132	
133	yavellana	.	..	x	....	....	....	......	.	133	K
134	andongensis	.	..	......	....	....	....	x.....	.	134	
135	cameronii	.	..	......	....	....	....	.xxxx.	.	135	
136	palmiformis	.	..	......	....	....	....	x.....	.	136	
137	retrospiciens	.	..	....x.	....	....	....	......	.	137	
138	babatiensis	.	..	......	....	....	.x.......	......	.	138	K
139	elgonica	.	..	......	....	..x....	....	......	.	139	K
140	flexifolia	.	..	......	....	....	..x......	......	.	140	K
141	boscawenii	.	..	......	....	....	..x......	......	.	141	K
142	rabaiensis	.	..	....x.	....	...x.xx	....	......	.	142	K
143	dawei	.	xx	......	.x.x	....x..	....	......	.	143	K
144	gossweileri	.	..	......	....	....	....	x.....	.	144	
145	catengiana	.	..	......	....	....	....	x.....	.	145	
146	kedongensis	.	..	......	....	..x..x.	.x.......	......	.	146	K
147	ngobitensis	.	..	......	....	..xx...	....	......	.	147	K
148	nyiriensis	.	..	......	....	...x...	....	......	.	148	K
149	arborescens	.	..	......	....	....	....	..xxx.	x	149	
150	sebaea	.	..	..x...	....	....	....	......	.	150	
151	eminens	.	..	....x.	....	....	....	......	.	151	

THE NUMBER OF ALOE SPECIES IN EACH AREA

West tropical Africa 4, of which 1 endemic
Central tropical Africa excluding Rwanda-Burundi 12
Rwanda-Burundi 5
Central tropical Africa including Rwanda-Burundi 15, of which 2 are confined to the area

Sudan Republic 8
Eritrea 7
Arabia 18, of which 2 also in Africa
Socotra 3, all endemic
Somalia 20
Ethiopia (excluding Eritrea) 25
North Eastern Africa and Arabia as a whole 68, of which 53 are confined to the area

Uganda 1 (Northern Province) 9
U 2 (Western Province) 4
U 3 (Eastern Province) 2
U 4 (Buganda) 3
Uganda as a whole 14, of which 3 endemic

Kenya 1 (North Eastern Province) 9
K 2 (Turkana) 4
K 3 (Rift Valley Province) 7
K 4 (Central Province) 12
K 5 (Lake Province) 1
K 6 (Masai Province) 5
K 7 (Coast Province) 9
Kenya as a whole 26, of which 6 endemic

Tanzania 1 (Lake Province) 6
T 2 (Northern Province) 8
T 3 (Tanga Province) 9
T 4 (Western Province) 9
T 5 (Central Province) 1
T 6 (Eastern Province) 3 and 1 doubtful
T 7 (Southern Highland Province) 8
T 8 (Southern Province) 4
T 9 (Zanzibar and Pemba) 3 all doubtful
Tanzania as a whole 30 and 1 doubtful, of which 14 endemic

East Africa (Uganda, Kenya and Tanzania) as a whole 54 and 1 doubtful, of which 32 are confined to the area

Angola 17
Zambia 15
Malawi 15
Portuguese East Africa 18
Rhodesia 25
Botswana 5
South Tropical Africa as a whole 47, of which 27 are confined to the area

South Africa 133, of which 11 occur also in Tropical Africa

Key to the species of Aloe occurring in Rwanda-Burundi, Uganda, Kenya and Tanzania anp adjacent parts of neighbouring countries. Based on the account of these species given in G. W. Reynolds "The Aloes of Tropical Africa and Madagascar" (1966).

Key to groups (these are artificial groups for the purpose of the key and not the more or less natural groups recognized by Dr. Reynolds in his book).

Branches of inflorescence 1–4:
- Acaulescent, or the stems under 50 cm. long:
  - Teeth on leaves under 5 mm. apart; leaves under 5 cm. wide at the base . . . Group 1
  - Teeth on leaves over 5 mm. apart, leaves often more than 5 cm. wide at the base . Group 2
- Stems over 50 cm. long; teeth on leaves over 5 mm. apart:
  - Bracts more than half as long as pedicel . . . . Group 3
  - Bracts less than half as long as pedicel . . . . Group 4

Branches of inflorescence 5 or more:
- Acaulescent, or stems under 50 cm. long:
  - Bracts more than half as long as pedicel:
    - Outer perianth segments united for more than 60% of their length . . . Group 5
    - Outer perianth segments united for less than 60% of their length . . . . Group 6
  - Bracts less than half as long as pedicel:
    - Outer perianth segments united for 60% or more of their length . . . . Group 7
    - Outer perianth segments united for less than 60% of their length . . . . Group 8
- Stems over 50 cm. long:
  - Bracts more than half as long as pedicel . . . . Group 9
  - Bracts less than half as long as pedicel:
    - Outer perianth segments united for 60% or more of their length . . . . Group 10
    - Outer perianth segments united for less than 60% of their length . . . . Group 11

Group 1

Rootstock not a bulb; leaves with a few spots at the base:
- Bracts up to 15 mm. long, pedicels over **10 mm.** long:
  - Bracts as long as pedicels; perianth 15–20 mm. long, the outer tepals free to the base . . . . . . 1 *myriacantha* (Haw.) R. & S.
  - Bracts ½–2/3 as long as pedicels; perianth 38–42 mm. long, the outer tepals 10–75% united . . . . . 12 *nuttii* Bak.
- Bracts up to 4 mm. long; pedicels 5–7 mm. long; perianth 27 mm. long, the outer tepals 75% united . . . 18 *jacksonii* Reynolds

Rootstock a bulb; leaves without spots; outer tepals 60–70% united:
- Bracts 25–30 mm., pedicels 5–7 mm., perianth up to 48 mm. long . . . . 13 *richardsiae* Reynolds
- Bracts 8–10 mm., pedicels 4–5 mm., perianth 30 mm. long . 14 *bullockii* Reynolds

Group 2

- Bracts under 7 mm. long; pedicels under 12 mm. long:
  - Leaves under 5 cm. wide; perianth under 28 mm. long:
    - Leaves under 2 cm. wide — 18 *jacksonii* Reynolds
    - Leaves over 2 cm. wide:
      - Bracts more than $\frac{1}{2}$ as long as pedicels — 128 *zanzibarica* Milne-Redhead
      - Bracts less than $\frac{1}{2}$ as long as pedicels — 129 *tororoana* Reynolds
  - Leaves 5 cm. or more wide:
    - Perianth under 25 mm. long — 129 *tororoana* Reynolds
    - Perianth over 30 mm. long:
      - Bracts shorter than pedicels:
        - Pedicels under 12 mm. long:
          - Bracts 3 mm. long; stamens exserted — 24 *dorotheae* Berger
          - Bracts 6 mm. long; stamens not exserted — 25 *morogoroensis* Christian
        - Pedicels over 15 mm. long; bracts 5 mm. long — 102 *ukambensis* Reynolds
      - Bracts longer than pedicels — 57 *massawana* Reynolds
- Bracts over 7 mm. long:
  - Pedicels under 11 mm. long:
    - Teeth on leaves about 8 mm. apart — 26 *greenwayi* Reynolds
    - Teeth on leaves over 10 mm. apart:
      - Bracts about 7 mm. long — 57 *massawana* Reynolds
      - Bracts about 12 mm. long — 131 *deserti* Engl.
  - Pedicels 14 mm. long, or more:
    - Perianth under 25 mm. long — 27 *amudatensis* Reynolds
    - Perianth over 27 mm. long:
      - Bract $\frac{1}{2}$ as long as pedicel; leaves 3 times as long as wide — 41 *mzimbana* Christian
      - Bract more than $\frac{1}{2}$ as long as pedicel; leaves 6–9 times as long as wide:
        - Perianth 35 mm. long — 70 *compacta* Reynolds
        - Perianth 28–33 mm. long — 99 *sereti* De Wild.

Group 3

- Bracts shorter than the pedicels:
  - Pedicels 15–20 mm. long; leaves without, or with few dots:
    - Leaves 2.5–4 cm. wide:
      - Infloresecence not pendent; bracts 7 mm. long — 64 *confusa* Engl.
      - Inflorescence pendent; bracts 10 mm. long — 67 *penduliflora* Bak.
    - Leaves 7–8 cm. wide; bracts 13 mm. long — 70 *compacta* Reynolds
  - Pedicels under 10 mm. long:
    - Pedicels c. 7 mm. long; leaves with many dots — 128 *zanzibarica* Milne-Redhead
    - Pedicels 1–2 mm., bracts 1 mm. long — 92 *mawii* Christian
- Bracts longer than the pedicels:
  - Bracts 12, pedicels 7–8, perianth 32–35 mm. long — 131 *deserti* Engl.
  - Bracts up to 30, pedicels 20–25, perianth 38–40 mm. long — 139 *babatiensis* Christian

Group 4

- Stems hanging; leaves 2.5–4 cm. wide; bracts 6–10 mm. long:
  - Perianth 25 mm. long — 65 *veseyi* Reynolds
  - Perianth 30 mm. long — 64 *confusa* Engl.
- Stems not hanging; perianth 33 mm. long, or more:
  - Pedicels 1–2 mm. long; leaves up to 10 cm. wide — 92 *mawii* Christian
  - Pedicels over 12 mm. long:
    - Perianth 40 mm. long; leaves 9 cm. wide; pedicels 20–25 mm. long — 139 *elgonica* Bullock
    - Perianth 33–36 mm. long:
      - Pedicels 14 mm. long; leaves 6–9 cm. wide — 143 *dawei* Berger
      - Pedicels 20–25 mm. long:
        - Leaves about 3.5 cm. wide — 146 *kedongensis* Reynolds
        - Leaves about 5 cm. wide — 147 *ngobitensis* Reynolds

Group 5

Bracts not above 7 mm. long; pedicels under 11 mm. long:	
Perianth over 25 mm. long:	
Perianth 29–30 mm. long; leaves with many spots:	
Teeth on leaves 4–6 mm. apart	20 *erensii* Christian
Teeth on leaves 10 mm. or more apart	23 *pirottae* Berger
Perianth 40–45 mm. long, leaves without spots	73 *christianii* Reynolds
Perianth 16–20 mm. long; leaves without, or with few spots	97 *ruspoliana* Bak.
Bracts over 9 mm. long; pedicels usually over 11 mm. long:	
Bracts shorter than the pedicel:	
Leaves with many dots:	
Perianth with a pronounced basal swelling, markedly constricted above this:	
Bracts 2–3 mm. broad; pedicels 20 mm. or more long:	
Perianth 33 mm. long	28 *graminicola* Reynolds
Perianth 35–38 mm. long	36 *lateritia* Engl.
Bracts 6 mm. broad; pedicels 16 mm. long	29 *kilifiensis* Christian
Perianth not constricted above the base; bracts 10 mm. broad; pedicels 13 mm. long	68 *venusta* Reynolds
Leaves with few or no dots:	
Bracts 10, pedicels 14, perianth 38 mm. long	72 *crassipes* Bak.
Bracts 5–6, pedicels 8–10, perianth 40–45 mm. long	73 *christianii* Reynolds
Bracts longer than the pedicel:	
Leaves spotted, 8 cm. wide	69 *macrosiphon* Bak.
Leaves not spotted, 4 cm. wide	130 *hendrickxii* Reynolds

Group 6

Bracts over 7 mm. long:	
Leaves up to 9 cm. wide, with many spots:	
Perianth sharply constricted above the ovary	29 *kilifiensis* Christian
Perianth not sharply constricted above the ovary:	
Bracts deflexed, twice as long as the 6–7 mm. long pedicels	60 *otallensis* Bak. var. *elongata* Berger
Bracts erect, shorter than or less than 50% longer than the pedicels:	
Bracts c. 11 mm. long, 10 mm. broad, as long as the pedicels	68 *venusta* Reynolds
Bracts 15 mm. long, 8 mm. broad, 50% longer than the pedicels	69 *macrosiphon* Bak.
Leaves up to 15 cm. wide, not, or hardly, spotted	80 *wrefordii* Reynolds
Bracts under 7 mm. long:	
Flowers all turned to one side of the inflorescence rhachis ("secund"); teeth on leaves 2 mm. or more long, 10 mm. or more apart:	
Perianth c. 25 mm. long; leaves with few-many spots	87 *turkanensis* Christian
Perianth over 29 mm. long; leaves without spots:	
Leaves c. 6 cm. wide; perianth 30 mm. long	88 *leachii* Reynolds
Leaves 12–24 cm. wide; perianth 35 mm. long	90 *secundiflora* Engl.
Flowers not "secund"; perianth under 35 mm. long; teeth on leaves small (up to 1 mm. long); 5–8 mm. apart in lower part of leaf:	
Perianth 16–20 mm. long, the outer segments united for 60% of their length	97 *ruspoliana* Bak.
Perianth c. 23 mm. long, the outer segments united for 45% of their length	115 *microdonta* Chiov.

Group 7

Bracts 10 mm. long or more; perianth 35 mm. long or more, sharply contracted just above the ovary:	
Bracts less than half as long as pedicels:	
Pedicels c. 30 mm. long, leaves 10–12 cm. wide	32 *duckeri* Christian
Pedicels c. 35 mm. long, leaves 8–9 cm. wide	36 a *lateritia* Engl. var. *lateritia*

Group 7 (Continued)

Bracts 16 mm. long, equalling the pedicels	36 b *lateritia* Engl. var. *kitaliensis* (Reynol.) Reynolds
Bracts under 7 mm. long; perianth not sharply contracted just above the ovary, though sometimes trigonously indented:	
Perianth markedly trigonously indented above the ovary:	
Pedicels 20–25 mm. long; perianth 35–40 mm. long; teeth on leaves usually under 10 mm. apart . . .	38 *chabaudii* Schonl.
Pedicels under 15 mm. long; perianth not over 35 mm. long; teeth on leaves 10 mm. or more apart:	
Leaves about 8 cm. wide	39 *bukobana* Reynolds
Leaves up to 17 cm. wide	42 *rivae* Bak.
Perianth not markedly trigonously indented above the ovary:	
Leaves 6–8 cm. wide:	
Perianth 20–25 mm. long; leaves not spotted . .	98 *classenii* Reynolds
Perianth 28–30 mm. long:	
Spots on leaves few or none; perianth 30 mm. long .	100 *mubendiensis* Christian
Spots on leaves many; perianth 28 mm. long . .	112 b *schweinfurthi* Bak. var. *labworana* Reynolds
Leaves 16–18 cm. wide, not spotted	116 *marsabitensis* Verdoorn & Christian

Group 8

Perianth over 32 mm. long:	
Perianth markedly trigonously indented above the ovary the outer segments united for 60% of their length	42 *rivae* Bak.
Perianth not markedly trigonously indented above the ovary, the outer segments free to the base	114 *macleayi* Reynolds
Perianth under 30 mm. long:	
Pedicels 15 mm., perianth 28 mm. long	101 *wilsonii* Reynolds
Pedicels under 11 mm. perianth under 26 mm. long:	
Leaves about 16 cm. wide, the teeth 20–25 mm. apart .	84 *calidophila* Reynolds
Leaves under 14 cm. wide, the teeth up to 16 mm. apart:	
Leaves many-spotted, c. 13 cm. wide . . .	104 *tweediae* Christian
Leaves with few or no spots, under 12 cm. wide:	
Leaves 7–8 cm. wide; pedicels 8–10 mm. long . .	98 *classenii* Reynolds
Leaves 9–11 cm. wide; pedicels 5–6 mm. long . .	115 *microdonta* Chiov.

Group 9

Bracts over 10 mm. long:	
Perianth 27–28 mm. long, the outer segments free for half their length	60 *otallensis* Bak.
Perianth 35 mm. long, the outer segments united for 70% of their length	70 *compacta* Reynolds
Bracts under 7 mm. long:	
Pedicels 8 or more mm. long:	
Perianth 40–45 mm. long	73 *christianii* Reynolds
Perianth 33–35 mm. long:	
Stems slender, up to 6 m. tall, free from dead leaves; outer perianth segments united for 1/3 of their length	125 *ballyi* Reynolds
Stems up to 1 m. tall, leafy; outer perianth segments united for 2/3 of their length . .	140 *flexifolia* Christian
Pedicels under 7 mm. long; perianth under 26 mm. long:	
Perianth over 21 mm. long:	
Leaves with few or many spots all over them . .	87 *turkanensis* Christian
Leaves unspotted, or with a few spots at the base only .	115 *microdonta* Chiov.
Perianth 16–20 mm. long	97 *ruspolaina* Bak.

Group 10

Perianth under 30 mm. long; bracts under 4 mm. long:	
Leaves under 9 cm. wide:	
Perianth 20–25 mm. long, 7 mm. wide across the ovary .	98 *classenii* Reynolds
Perianth 27 mm. long, 5–6 mm. wide across the ovary .	133 *yavellana* Reynolds
Leaves 16–18 cm. wide	116 *marsabitensis* Verdoorn & Christian
Perianth over 30 mm. long:	
Leaves up to 17 cm. wide	42 *rivae* Bak.
Leaves under 11 cm. wide:	
Teeth on leaves 1–2 mm. long	140 *flexifolia* Christian
Teeth on leaves 3 mm. or more long:	
Leaves 5 cm. wide	147 *ngobitensis* Reynolds
Leaves 6 or more cm. wide:	
Perianth 40 mm. long	148 *nyeriensis* Christian
Perianth under 36 mm. long:	
Pedicels 18 mm., bracts 7 mm. long . . .	142 *rabaiensis* Rendle
Pedicels 14–15 mm., bracts 4–5 mm. long:	
Stems stffly erect, simple, or with 1 or 2 branches from the base, up to 4 mm. tall . . .	126 *volkensii* Engl.
Stems erect or spreading, forming clumps 1–2 m. tall	143 *dawei* Berger

Group 11

Pedicels under 13 mm. long:	
Perianth over 30 mm. long	42 *rivae* Bak.
Perianth under 28 mm. long:	
Leaves over 12 cm. wide:	
Teeth on leaves 20–25 mm. apart, leaves unspotted .	84 *calidophila* Reynolds
Teeth on leaves 10–15 mm. apart; leaves spotted near the base	104 *tweediae* Christian
Leaves under 12 cm. wide:	
Teeth on leaves up to 5 mm. long	98 *classenii* Reynolds
Teeth on leaves 1–2 mm. long	115 *microdonta* Chiov.
Pedicels over 14 mm. long:	
Leaves over 7 cm. wide:	
Perianth c. 35 mm. long	126 *volkensii* Engl.
Perianth 28–30 mm. long:	
Bracts 1-nerved	101 *wilsonii* Reynolds
Bracts 3-nerved	141 *boscawenii* Christian
Leaves under 7 cm. wide	147 *ngobitensis* Reynolds

(*Received* 21*st March*, 1967)

NOTE: Since this paper was received for publication we have heard with deep regret of the death of Dr. G.W. Reynolds.

MARINE BOTANY OF THE KENYA COAST

1. *A First List of Kenya Marine Algae*

By

WM. EDWYN ISAAC

University College, Nairobi

INTRODUCTION

Although there are scattered records of Kenya marine algae in the literature there is only one previous paper known to the author which is specifically on Kenya Marine Algae. This paper was published by Gerloff in 1960 and apart from recording *Lyngbya majuscula* and citing previous records of Cyanophyta, it deals with a collection of Chlorophyceae only (Gerloff, 1960). The list of species from the East African Herbarium, mostly collected by Greenway and Rawlins, and identified by Gerloff is given in an appendix. At present Gerloff's list is published without comment.

It is intended that the following list of Kenya marine algae will be followed by papers dealing more fully with the species and their distribution as well as with additional species.

The plants listed below were all collected by the author and he is responsible for the identifications unless otherwise stated.

Only a minimum of references to literature is included in this paper.

ACKNOWLEDGEMENTS

I wish to thank the Rockefeller Foundation whose financial support has made this work possible.

Thanks are also due to the Botany Dept., British Museum (Natural History) for providing me with working space and facilities in 1966 and for their kindness in providing photo-copies of relevant literature. To the Rijksherbarium, Leiden and to the Kew Herbarium for working space and access to collections also in 1966, thanks are due.

To Dr. William Randolph Taylor, I am indebted for identifying material of *Turbinaria* and describing two new species from the Kenya coast; to Margaret Steentoft for naming material of *Galaxaura*, and *Actinotrichia* and to Sophie Ducker for identifying *Chlorodesmis caespitosa* J. Ag. I also wish to thank Dr. A. B. Cribb for help in identifying some species, confirming my identifications of other species and for helpful discussions while we were both working at the Natural History Museum.

Lastly I wish to thank my wife for her constant help during my collecting excursions and in dealing with the herbarium material collected.

CHLOROPHYCEAE

Ulotrichales

Ulva fasciata Del.
U. lactuca L.
U. reticulata Forsk.
U. rigida C. Ag.

Cladophorales

Chaetomorpha crassa (C. Ag.) Kuetz.
Cladophora patentiramea (Mont.) Kuetz. forma *longiarticulata* Reinb. (Also known as *C. socialis* Kuetz)
C. prolifera (Roth) Kuetz.

Siphonales

Avrainvillea amadelpha (Mont.) A. & E. S. Gepp f. *montagneana* A. & E. S. Gepp
A. amadelpha f. *submersa* A. & E. S. Gepp
A. erecta (Berkeley.) A. & E. S. Gepp
A. lacerata J. G. Ag. f. *typica*
A. lacerata var. *robustior* A. & E. S. Gepp
A. obscura J. Ag.

Bryopsis hypnoides Lamour.
B. pennata Lamour.
B. plumosa (Huds.) C. Ag.

Caulerpa cupressoides (West) C. Ag.
C. fastigiata Mont.
C. lanuginosa J. Ag.
C. lentillifera J. Ag.
C. mexicana (Sond.) J. Ag.
C. pickeringii Harv. & Bail.
C. racemosa (Forsk.) J. Ag.
This is a very variable species. The following varieties have been distinguished on the Kenya coast:—
clavifera (Turn.) Web. v. B.
clavifera f. *macrophysa* Web. v. B.
gracilis (Zan.) Web. v. B.
laetevirens (Mont.) Web. v. B.
occidentalis (J. Ag.) Boergs.
peltata (Lamour.) Eubank
turbinata (J. Ag.) Eubank
uvifera (Turn.) Web. v. B.

C. scalpelliformis (R. Br.) C. Ag. including var.
denticulata (Decne.) Web. v. B.
C. serrulata (Forsk.) J. Ag. emend. Boergs.
C. sertularioides (Gmel.) Howe
C. taxifolia (Vahl) C. Ag.
C. verticillata J. Ag.
C. vickersiae Boergs.
C. webbiana Mont. f. *tomentella* (Harv.) Web. v. B.

Chlorodesmis caespitosa J. Ag. det. Mrs. S. Ducker. For validation of name see Ducker, Williams & Lance (1965).

Codium arabicum Kuetz.
C. capitatum Silva
C. duthiae Silva
C. lucasii Setch. subsp. *capense* Silva
C. prostratum Levr.

Halimeda discoidea Decne
H. incrassata (Ell.) Lamour.
H. macroloba Decne
H. opuntia (L.) Lamour.
H. stuposa Taylor
H. tuna (Ell. & Soland.) Lamour., including f. *platydisca* (Decne) Barton

Udotea flabellum (Ell. & Soland.) Howe
U. indica A. & E. S. Gepp
U. orientalis A. & E. S. Gepp

Siphonocladales

Anadyomene stellata (Wulf.) C. Ag.
A. wrightii Gray

Boergesenia forbesii (Harv.) Feldm.

Boodlea composita (Harv.) Brand

Chamaedoris auriculata Boergs.

Cladophoropsis membranacea (C. Ag.) Boergs.

Dictyosphaeria cavernosa (Forsk.) Boergs.
D. intermedia Web. v. B.
D. versluysii Web. v. B., *sens. lat.* (Valet, 1966)

Ernodesmis verticillata (Kuetz.) Boergs.

Nereodictyon imitans Gerloff

Struvea anastomosans (Harv.) Piccone
S. ramosa Dickie

Valonia aegagropila C. Ag.
V. macrophysa Kuetz.
V. utricularis (Roth) C. Ag.
V. ventricosa J. Ag.

Valoniopsis pachynema (Mart.) Boergs.

Dasycladales

Neomeris vanbosseae Howe

PHAEOPHYTA

Ectocarpales

Giffordia mitchellae (Harv.) Hamel

Dictyotales

Dictyopteris delicatula Lamour.

Dictyota bartayresiana Lamour.
D. ciliolata Kuetz.
D. dichotoma (Huds.) Lamour.
D. divaricata Lamour.
D. pardalis Kuetz.
D. pardalis f. *pseudohamata* Cribb (1954, p. 22, Plate 3, fig. 10), det. Cribb.

Padina commersonii Bory
P. gymnospora (Kuetz.) Vickers
P. tetrastromatica Hauck

Pocockiella variegata (Lamour.) Papenf.

Stoechospermum marginatum (C. Ag.) Kuetz.

Stypopodium zonale (Lamour.) Papenf.

Punctariales

Colpomenia sinnosa (Roth) Derb. & Sol.

Hydroclathrus clathratus (Bory) Howe

Fucales

Cystophyllum trinode (Forsk.) J. Ag. "Renamed *Cystoseira trinodis* (Forsk.) C. Ag. by Papenfuss (1967)."

Cystoseira myrica (Gmel.) J. Ag.

Hormophysa articulata Kuetz.
H. triquetra (L.) Kuetz. (*H. articulata* is often included in this species).

Sargassum duplicatum J. Ag.
S. latifolium (Turn.) C. Ag.

Turbinaria
The taxa of *Turbinaria* listed below have been named or confirmed by Wm. Randolph Taylor.

Turbinaria condensata Sond.
T. conoides (J. Ag.) Kuetz.
T. crateriformis Taylor, 1966
T. kenyaensis Taylor, 1966
T. murrayana Barton
T. ornata J. Ag. including f. *ecoronata* Taylor, f. *evesiculosa* (Barton) Taylor

RHODOPHYTA

Nemalionales

Actinotrichia fragilis (Forsk.) Boergs., det. Margaret Steentoft

Asparagopsis taxiformis (Del.) Coll. & Herv.

Galaxaura squalida Kjellm., det. Margaret Steentoft
G. subverticillata Kjellm., det. Margaret Steentoft

Liagora caenomyce Decne
L. ceranoides Lamour. var. *leprosa* (J. Ag.) Yam.
L. ceranoides var. *pulverulenta* (C. Ag.) Yam.
L. mauritiana Boergs. Typically epiphytic on *Cymodocea ciliata* Ehrenb. ex Asch.
L. valida Harv.

Scinaia indica Boergs. Cast up.

Gelidiales

Gelidiella acerosa (Forsk.) Feldm. & Hamel

Gelidium caespitosum Kylin
G. crinale (Turn.) Lamour.
G. pusillum (Stackh.) Le Jolis

Pterocladia capillacea (Gmel.) Bornet & Thur.

Cryptonemiales

A. Corallinaceae.
Amphiroa beauvoisii Lamour., confirmed by A. B. Cribb

Corallina mauritiana Boergs.

Jania capillacea Harv., confirmed by A. B. Cribb

B. Non-Corallinaceae.
Chondrococcus harveyi (J. Ag.) De Toni. On further study this may prove to be a smaller, more delicate form of *C. hornemanni.*
C. hornemanni Kylin

Grateloupia filicina (Wulf.) C. Ag.

Halymenia venusta Boergs.

Gigartinales

Eucheuma denticulatum (N. L. Burman) Coll. & Herv. (Dixon, 1962)
E. horridum (Harv.) J. Ag.
E. serra J. Ag.
E. striatum Schmitz

Gelidiopsis scoparia (Mont. & Mill.) Schmitz

Gracilaria cacalia (J. Ag.) Dawson
G. crassa (Harv.) J. Ag.
G. edulis (Gmel.) Silva
G. millardetii (Mont.) J. Ag.
G. verrucosa (Huds.) Papenf. Cast up.

Hypnea cervicornis J. Ag.
H. cornuta (Lamour.) J. Ag.
H. harveyi Kuetz.
H. musciformis (Wulf.) Lamour.
H. rosea Papenf.
H. valentiae (Turn.) Mont.
Boergesen follows Hauck in that he includes *H. cornuta* in this species. (Boergesen, 1943, p. 59.)

Rhodymeniales

Botryocladia chiajeana (Meneghini) Kylin
B. kuckuckii (Web. v. B.) Yam. & Tanaka
B. leptopoda (J. Ag.) Kylin, det. A. B. Cribb

Champia compressa Harv.
C. globulifera Boergs.
C. parvula (C. Ag.) Harv.
C. vieillardii Kuetz. De Toni (1900:561) included this species in *C. compressa* Harv. but the author concurs with Dawson (1954) in upholding Kuetzing's species.

Coelarthrum boergesenii Web. v. B.

Ceramiales

Acanthophora delilei Lamour. Included, at least in part, by some authors in *A. muscoides*
A. muscoides (L.) Bory
A. spicifera (Vahl) Boergs.

Amanzia glomerata C. Ag.

Centroceras clavulatum (C. Ag.) Mont.

Chondria armata (Kuetz.) Okam. Also known as *Rhodomela crassicaulis* Harv. Okamura (1907; p. 69, pl. 16) maintains that on a structural basis this plant should be regarded as a *Chondria*.

Dasya scoparia Harv.

Dictyurus purpurascens Bory

Digenea simplex (Wulf.) C. Ag.

Laurencia flexilis Setch. det. A. B. Cribb
L. obtusa (Hud.) Lamour., including var. *natalensis* (Kylin) Boergs.
L. papillosa (Forsk.) Grev.
L. perforata (Bory) Mont., det. A. B. Cribb

Leveillea jungermannioides (Mart. & Herv.) Harv.

Martensia elegans Herv.

Neurymenia fraxinifolia (Mert.) J. Ag.

Polysiphonia ferulacea Suhr. ex J. Ag.
P. variegata (C. Ag.) Zan.

Spyridia cupressina Kuetz.
S. filamentosa (Wulf.) Harv.
S. insignis J. Ag.

Vanvoorstia spectabilis Harv.

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APPENDIX

GERLOFF'S LIST OF SPECIES

The species are arranged in order as they appear in his paper but omitting family headings.

Cyanophyta:

Lyngbya majuscula Harv. ex Gomont

Chlorophyta:

Ulvales:

Ulva lactuca L.
U. rigida (C. Ag.) Thuret
U. reticulata Forsk.

Cladophorales:

Chaetomorpha crassa (Ag.) Kuetz.

Siphonocladales:

Valonia aegagropila Ag.

Dictyosphaeria cavernosa (Forsk.) Boergs.
D. intermedia Web. v. B.

Boergesenia forbesii (Harv.) Feldm.

Chamaedoris delphinii (Hariot) Feldm. & Boergs

Ernodesmis verticillata (Kuetz.) Boergs.

Boodlea composita (Harv.) Brand

Spongocladia vaucheriaeformis Aresch.

Nereodictyon imitans Gerloff *spec. nov.*

Anadyomene stellata (Wulf.) J. Ag.

Dasycladales:

Neomeris vanbosseae Howe

Caulerpales:

Caulerpa webbiana Mont. f. *tomentella* Web. v. B.
C. scalpelliformis (R. Br.) Web. v. B.
C. sertularioides (Gmel.) Howe
C. serrulata (Forsk.) J. Ag. emend. Boergs.
C. racemosa Forsk. var. *clavifera* (Turn.) Web. v. B.
C. racemosa Forsk. var. *clavifera* f. *macrophysa* (Kuetz.) Web. v. B.
C. racemosa var. *uvifera* (Turn.) Web. v. B.

Avrainvillea erecta (Berkeley) Gepp
A. obscura (Ag.) J. Ag.
Chlorodesmis hildebrandtii A. & E. S. Gepp

Udotea indica A. & E. S. Gepp
U. orientalis A. & E. S. Gepp

Halimeda tuna (Ell. & Soland.) Lamour.
f. *tuna*
f. *platydisca* (Decne.) Barton
H. cuneata Hering
H. opuntia (L.) Lamour.
H. opuntia f. *triloba* (Decne.) Barton
H. macroloba Decne.

Codium duthieae Silva
C. dwarkense Boergs.

(*Received 1st July, 1967*)

NOTES ON A COLLECTION OF AMPHIBIANS FROM ETHIOPIA

By

EMIL K. URBAN

(*Department of Biology, Faculty of Science, Haile Sellassie I University, Addis Ababa, Ethiopia*)

From 1962 through 1965 various members of the Faculty of Science of Haile Sellassie I University accumulated a series of amphibian specimens from Ethiopia. Except for duplicate specimens which are housed in the Biology Department of Haile Sellassie I University, the collection has been deposited in the Field Museum of Natural History, Chicago, Illinois. Because the species, distribution, and ecology of amphibians of Ethiopia are poorly known, an obvious need exists for papers, large and small, that deal with Ethiopian frogs, toads, and caecilians. Hence, I present below specific comments on this collection.

I am indeed grateful to Drs. R. F. Inger and H. Mark of the Field Museum of Natural History for identifying the amphibians in this collection. Moreover, I should like to acknowledge the various collectors mentioned in the text below. Since the literature on amphibian classification is severely limited in the library of Haile Sellassie I University, classification in this paper is based on that supplied by Inger and Marx and where appropriate supplemented by that found in Loveridge (1957, Check list of the reptiles and amphibians of East Africa, *Bull. Mus. Comp. Zool.*, Vol. 117, No. **2**: 1–362).

Xenopus clivii Peracca. On 17 October, 1964, I collected adults as well as tadpoles in a pond about 200 meters from Gaferssa Reservoir, 18 kilometers west of Addis Ababa along the Ambo Road. The seasonal pond, approximately 2,585 meters in elevation, results from overflow of one stream which supplies the reservoir during the long rains (June-October). *Juncus*, *Cyperus*, and *Polygonum* are the major plants associated with the pond.

Bufo regularis Reuss. This ubiquitous toad was obtained in several months of the year at different localities ranging from approximately 535 to 2,585 meters in elevation. On 6 January, 1963, E. W. Beals collected specimens 70 kilometers east of Bati at Waranzo watercourse next to a small pool under a bridge at about kilometer 485 on the Asaab Road (11°20′N, 40°42′E), about 535 meters high; on 25 April, 1965, in a sandy open scrub of *Salvadora* and *Tamarix* with a ground cover of *Zygophyllum* some 20 kilometers north of Era Gota, about 1,185 meters in elevation, and on 16 July, 1963, in an *Acacia* woodland 4 kilometers south of Meki in the Rift Valley, about 1,640 meters high. R. Baxter collected this species along the west shore of Lake Langano, about 1,585 meters high, on 2 November, 1962, while J. M. Prosser and P. Chen caught it along the shore of Lake Awasa, about 1,680 meters high, on 3–4 May, 1963. I collected specimens in semi-desert bush, 48 kilometers north of Awash Station, about 830 meters high, on 14 November, 1964; in my garden in Addis Ababa, about 2,420 meters high, on 29 November, 1964; and along the shores of the pond some 200 meters from Gaferssa Reservoir, 18 kilometers west of Addis Ababa, about 2,585 meters high, on 10 October, 1964.

Bufo dodsoni Boulenger. Beals collected this toad at the Loggia watercourse, which contained *Tamarix*, 7 kilometers east of Tandaho along the Assab Road (11°44′N, 40°58′E), about 380 meters in elevation, on 6 January, 1963.

Leptopelis gramineus (Boulenger). I collected one transforming larva in the pond some 200 meters from Gaferssa Reservoir, 18 kilometers west of Addis Ababa on the Ambo Road, about 2,585 meters high, on 17 October, 1964.

Rana abyssinica Peters. Beals obtained a large series of this species from the Danakil desert at Waranzo watercourse next to and in a small pool under a bridge on the Assab Road (70 kilometers east of Bati, at kilometer 485; (11°20′N, 40°42′E), about 535 meters high, on 6 January, 1963. Baxter collected this frog along the west shore of Lake Langano, about 1,585 meters high, on 2 November, 1962.

Rana angolensis Bocage. I obtained this frog along small streams which cross the Blue Nile Road, 30 kilometers north of Addis Ababa, about 2,600 meters in elevation, on 18 October, 1964; most were captured 1–3 meters above the stream along ploughed banks which contained a new growth of unidentified weeds. Also I collected this species in the pond some 200 meters from Gaferssa Reservoir, 18 kilometers west of Addis Ababa, about 2,585 meters high, on 17 October, 1964.

Rana cooperi Parker. Beals obtained this species in Addis Ababa in the garden of Haile Sellassie I University's Faculty of Science, about 2,420 meters high, on 24 June, 1963. I obtained specimens along small streams which cross the Blue Nile Road, 30 kilometers north of Addis Ababa, about 2,600 meters high, on 18 October, 1964. As with *R. angolensis*, I found them along ploughed stream banks that had new growth of unidentified weeds.

Rana mascareniensis Duméril & Bibron. Beals and I obtained a large series of this species in the bullrushes halfway down the east shore of Lake Abaya one kilometer south of the ferry landing, about 1,240 meters high, on 28 November, 1964. Earlier, on 17 July, 1963, Beals collected this species in a marsh on the west shore of Lake Zwai, about 1,625 meters in elevation and opposite kilometer 159 on the Addis Ababa-Shashamanne-Awasa Road.

Rana ornata (Peters). Specimens of this frog were collected by Beals in a small muddy pond, 4 by 3 meters in size and associated with an *Acacia-Euphorbia* woodland, 9 kilometers south of Lake Langano village at kilometer 218 on the Addis Ababa-Shashamanne-Awasa Road, about 1,750 meters high, on 6 July, 1963; by R. B. Wood and Prosser along the shore of Lake Awasa, about 1,680 meters in elevation, on 3 May, 1963; and by Prosser in her garden in Addis Ababa, about 2,420 meters high, on 15 January, 1965.

(*Received* 20*th March*, 1967)

NATURE NOTES

LESSER SPOTTED EAGLE ON MIGRATION

On November 11th this year, while travelling from Mombasa to Nairobi I noticed, a mile or so west of Sultan Hamud, numbers of large birds circling the sky. I thought at first that they were vultures. On approaching the area I noticed numbers of these birds standing on the road and feeding on the verges and adjacent fields. I stopped noting to my surprise that the birds were eagles about the size of the Tauny but a darker brown spotted on the coverts. These, I thought were Wahlbergs, but seeing them in such numbers made me doubtful, never having seen eagles in E. Africa in greater numbers than 4 and 6.

The country is open savannah, there had been considerable rain over the previous days and the time was midday. Over an area of 3–4 miles of road there must have been many thousands of these birds, on the wing and on the ground; they were eating insects, probably termites and undisturbed by passing traffic. In 38 years in E. Africa I have never seen the like so I consulted my friend Leslie Brown who thought they might have been the Lesser Spotted Eagle. On referring to English books and illustrations I concur; this must have been a vast migration, probably southwards.

23rd December, 1966. Roger V. Bowles, M.D.

POSSIBLE OCCURRENCE OF THE WHALE-HEADED STORK IN ETHIOPIA

The Whale-headed Stork (*Balaeniceps rex* Gould) is known from The Sudan, Chad, Congo, Ruanda, Uganda, Tanzania, and Zambia (Burton & Benson, 1961, *N. Rhodesia J.*, **4**: 416–418). In the Sudan it is resident in the swamps of the Bahr el Ghazal and upper White Nile and is found as far north as Kodok on the Nile (Cave & Macdonald, 1955, Birds of The Sudan, p. 61). The Whale-headed Stork thus far has not been recorded in Ethiopia (Urban & Brown, 1967, Preliminary Checklist of the Birds of Ethiopia, MS).

Recently Mr. Thomas Mattanovich of Addis Ababa informed me that he twice saw this species in western Ethiopia along the Baro River in 1961 or 1962. While travelling in a canoe, he noted the stork standing along side the river approximately 20 kilometers west of Gambela in the rainy season (May-October) and again about 100 kilometers west of Gambela in the dry season (November-April). In both instances he saw the storks standing in grass with marshy areas nearby.

The possible occurrence of the Whale-headed Stork in western Ethiopia is not unexpected. The Baro River, with numerous papyrus swamps along its shores, flows westward into the Sobat River which in turn enters the White Nile several kilometers south of Kodok, the northern limit of the stork's distribution in eastern Sudan. The species is apparently not uncommon in the Bahr el Ghazal and the Sudd, swampy regions of the Nile about 100 kilometers west of where the Sobat flows into the Nile (Burton & Benson, *op. cit.*). It is reasonable to assume that the Whale-headed Stork occurs in suitable habitats from the Bahr el Ghazal and the Sudd of the White Nile to the Sobat River in The Sudan and the Baro River in Ethiopia.

Mattanovich, who has spent several years in this biologically unknown area of western Ethiopia, is reputed to be an excellent observer. Only recently he reported and Mr. John Blower, Senior Game Warden of the Imperial Ethiopian Government Wild Life Conservation Department, collected from the Baro River-Gambela area the first Nile Lechwe [*Onotragus megaceros* (Fitzinger)] from Ethiopia. Although

Mattanovich's identification of the stork is probably correct, the occurrence of this species in Ethiopia needs further confirmation. Expeditions to determine the status of this species in western Ethiopia certainly are now needed.

27th February, 1967

EMIL K. URBAN
Addis Ababa

BOOK REVIEWS

FLORA OF TROPICAL EAST AFRICA

Berberidaceae by R. M. Polhill, 4 pages, 1 fig., Sh. 1/25; *Tamaricaceae* by D. R. Hunt, 4 pages, 1 fig., Sh. 1/25; *Pittosporaceae* by G. Cufodontis, 15 pages, 2 fig., Sh. 2/25; *Tecophilaeaceae* by S. Carter, 8 pages, 3 fig., Sh. 1/70; *Juncaceae* by S. Carter, 12 pages, 3 fig., Sh. 2/-.

Published under the authority of the Minister for Overseas Development, London, and obtainable from the Government Printers, Box 9124, Dar es Salaam, Box 53, Entebbe and Box 30128, Nairobi, or from the Govt. Bookshop, Box 569, London, S.E.1.

These 5 parts which appeared on 11 November, 1966, fully maintain the high standard expected of this Flora. They bring the total number of families now published up to 46, including in all 221 genera and 885 species. It is pleasing to see that the recently adopted policy of appointing a junior botanist at Kew (Mr. Polhill), who is less preoccupied with administration than are his seniors, as one of the editors has led to a speed-up in publication. He informs us that 3 further families, all large (*Caesalpinioideae*, *Cucurbitaceae* and *Sapotaceae*), are now with the printers, while 8 smaller families are also ready to go to press. It is also most pleasing to report the high standard of efficiency of the Nairobi Government Printer's sales department which now supplies without delay over the counter, or by post, any part of this flora, thus obviating the delay and increased postal charges involved in ordering from London.

The first three families now reviewed are woody Dicotyledons. *Berberis* (1 sp.) and *Pittosporum* (6 spp.) are found in upland woodland or forest, *Tamarix* (2 spp.) by water-courses in the drier parts of Kenya and Tanzania.

The other two families are herbaceous Monocotyledons. *Juncus* (5 spp.) and the related *Luzula* (3 spp.) occur in wet places in the uplands and mountains, while *Cyanastrum* (3 spp.) and *Walleria* (1 sp.), both in the *Tecophilaeaceae*, are found in various vegetation-types below 1,500 m. in Tanzania.

J. B. G.

"EAST AFRICAN WEEDS AND THEIR CONTROL"

By

G. W. IVENS

243 pages, 113 line drawings, O.U.P., Nairobi, 1967, Sh. 6/50.

Some 220 common East African Weeds are described in 110 groups of one or a few related species each of which is illustrated. These groups are arranged under the headings "Water Weeds", "Grasses and nutgrasses" (Cyperaceae), "Woody Weeds" and "Herbaceous Weeds". A concise botanical description of each weed or small group of related weeds is followed by accounts of its distribution and economic significance in East Africa and of the known methods of control. In addition there is a list and chemical classification of the herbicides referred to, a list of those species known, or thought, to be poisonous, a bibliography, a glossary and an index. Although primarily meant for the practical agriculturalist, this work will also be of value to everyone interested in plants in East Africa, especially on account of the pictures.

J. B. G.

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JOURNAL OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. XXVI No. 3 (115) JUNE 1967

Revised Catalogue of the

African Sphingidae (Lepidoptera)

with

Descriptions of the East African Species

by

R. H. CARCASSON

(Published 30/6/68)

Price Shs. 30/-

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References. These are usually abbreviated in the text and listed more fully in alphabetical order of authors at the end of the article. For example, in the text book reference might be (Pinhey 1956: p. 20). At the bottom of the contribution: Jackson, F. J., 1938. *Birds of Kenya and Uganda.* Pinhey, E. C. G., 1956. *The Emperor Moths of Eastern Africa.* J.E. Afr. Nat. Hist. Soc. XXIII No. 1, (98). With short articles it may not be worth making a list of references at the end, but the whole reference in the most abbreviated comprehensible form should then be inserted in the text.

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by

R. H. CARCASSON.

(*National Museum, Nairobi*)

INTRODUCTION

The present catalogue consists of a taxonomic revision of the Sphingid fauna of the Ethiopian Region, with descriptions of a number of new genera, species and subspecies as well as detailed descriptions and records of all the species known to occur in Ethiopia, Somalia, Socotra, the Sudan, Kenya, Uganda and Tanzania. For reasons of economy the genitalia and early stages have only been described and figured if previously undescribed, or if of special importance. Illustrations of all adult moths belonging to new species or subspecies and of all species not previously figured have been appended, as well as of many others of special interest. Details of illustrations of African Sphingids in other publications are given in the index. A more natural classification than any available hitherto has been proposed, based mainly on a more complete knowledge and understanding of the genital armatures of both sexes and on the early stages.

CLASSIFICATION AND NOMENCLATURE

In 1903, when Rothschild and Jordan published their classical revision of the world Sphingidae, they recognised a total of 722 species, 180 of which were African.

35 years later the family had risen to over 1,000 known species and in the present work 260 African species are recognised, 160 of which are known to occur in eastern Africa.

The majority of the Sphingidae are tropical insects, comparatively few occurring in the temperate regions; in North America the rather poor resident fauna is boosted by many species of migrants from tropical America; in the Old World only a few species migrate regularly from the tropics, owing to the presence of formidable east-west barriers such as the Sahara, the Mediterranean and the Himalayas.

Before 1903 the classification of the Sphingidae had been based on purely superficial characters with the result that many unrelated species were lumped together and many closely related species were placed in widely separated genera.

Rothschild and Jordan were the first to adopt a natural, phylogenetic classification in their monumental revision of the family. They used such characters as structure of

the antennae, spination of the legs and abdomen, structure of the palpi, pilifer and feet, and examined the genitalia of a large number of species.

Earlier classification had been based mainly on wing venation and shape, which are characters of very little value in the Sphingidae.

Rothschild and Jordan's classification of 1903 has been accepted, with a few minor changes, by all subsequent authors and is followed in this work. Rothschild and Jordan were pioneers in the practice of dissecting and examining the genital armatures and their rather crude methods (dry preparation, which is particularly unsatisfactory with the females), did not enable them to take these structures into sufficient account when defining genera and following up their relationships. In the Philampelini and Choerocampini this did not matter much as the genitalial structure of these insects is extremely uniform, but it did lead to a number of misconceptions in the more advanced Ambulicini. It has been one of the aims of this work to elaborate and perfect the classification of Rothschild and Jordan and to render it more compatible with a critical assessment of the genital armatures of both sexes.

The names proposed by R. & J. for supra-generic taxa have been adopted in this work, although older and more appropriate names are available in some cases; however, R. & J's. names have been in use for over 60 years and it would serve no useful purpose to change them. The only names which have had to be rejected are Sesiinae and Sesiicae, because the type genus of these groups (*Sesia* Fabricius) is not a Sphingid.

The other groups have been given the terminations recommended in the "International Code of Zoological Nomenclature" (1961). Rothschild and Jordan split the family into two "Divisions", three subfamilies and seven tribes. As the term "Division" has no status in nomenclature, it has not been used in this work, the term "subfamily", which is the next in rank after family, being used instead; all subsequent taxa above the rank of genus have been demoted by one step. Thus R. & J's. "tribes" become subtribes, a taxon which is not recognised by the Code of Zoological Nomenclature, but which is nevertheless useful. The alternative would have been to raise the two so-called "divisions" to family rank, a procedure which cannot be justified in view of the great compactness and isolation of the Sphingidae.

Family SPHINGIDAE Samouelle, 1819

Type species (designated by R. & J., 1903): *Smerinthus ocellatus* (L.)

Subfamily ASEMANOPHORINAE (R. & J.) 1903
Division ASEMANOPHORAE R. & J.
Subfamily ASEMANOPHORAE Janse 1932

No type species or genus has ever been designated for this Subfamily, but since it includes the type species of the family and is therefore the typical or nominate subfamily, its type species must be *Smerinthus oceallatus* L. (Europe). The correct name of the subfamily should be Smerinthinae Butler 1877. The type species was formerly

placed in the genus *Sphinx* L.

All the species of this subfamily lack the patch of sensory hairs on the inner surface of the first palpal segment. There is a tendency for the reduction of numerous characters which are well developed in the Semanophorinae, such as the frenulum, which however, is present in all the African species, the proximal pair of tibial spurs, the pulvillus and the paronychium and the modified scales of the male genitalia. On the other hand the genital armatures of the males tend to be much more complex and varied than in the Semanophorinae, the valve being frequently bilobed and provided with a harpe of varying structure and the uncus being sometimes bilobed and even trifid.

The larvae are always cylindrical and do not have the fifth segment enlarged, as in some members of the Semanophorinae.

Tribe AMBULICINI (Butler) 1877
Subfamily *Ambulicinae* Butler 1877
Subfamily *Ambulicinae* R. & J. 1903
Tribe *Ambulicini* Janse 1932

Type species (designated by R. & J., 1903) *Protambulyx strigilis* L. (America). *Smerinthus ocellatus* L., which is the type of the family and of the subfamily is included in this tribe and should therefore be its type species. The correct name of the tribe should be Smerinthini Butler 1877.

One of the largest groups in Africa. Proboscis usually reduced, often rudimentary, never longer than abdomen. All the African species are strictly nocturnal and none are known to feed on flowers. The females are usually larger than the males, broader winged, comparatively inactive and seldom attracted by light. Antennae never hooked, terminating in a short, densely scaled segment, usually more or less fasciculate, occasionally pectinate in the males (*Ceridia*, *Xenosphingia*). Lower margin of eye frequently ciliated. Male genitalia very complex and varied, modified scales small or absent. Outline of wings irregular in many genera. Venation very uniform. Vein 6 of forewing may arise at the end of the discoidal cell, or from a short stalk common to 7 and 8. Veins 6 and 7 of the hindwing may arise at the same point, or have a common stalk of varying length.

The larvae are cylindrical, covered in small granules or tubercles, sometimes in short branching or dentate spines. (*Lophostethus*, *Acanthosphinx*, *Rhadinopasa*). Pupae generally naked and subterranean, without free proboscis case.

The world distribution of the Ambulicini is as follows: the figures for the African genera and species are based on this work, those for the exotic species and genera on Rothschild and Jordan's Revision of 1903 and are about 80% of the present figure. This applies to the figures given for the other groups of Sphingida also.

	Indo-Australian	*Ethiopian*	*Palaearctic*	*American*	*Total*
Genera	20	31	9	10	60
Species	59	90	16	27	183

26 genera and 55 species occur in Eastern Africa.

Tribe ACHERONTIINI (Butler) 1877
Subfamily *Acherontiinae* Butler 1877
Subfamily *Acherontiinae* R. & J. 1903
Tribe *Acherontiini* Janse 1932
Type species *Acherontia atropos* L.

Very similar to previous tribe. Last antennal segment very long, usually hooked. Proboscis short to very long, only exceptionally rudimentary. Outline of wings always entire. Venation very uniform, as in previous tribe. Hindwing cell usually smaller. Sexual dimorphism very slight in most species. Genital armature much more uniform than in previous tribe, simpler; valve always entire, harpe simple, aedeagus unarmed; cornuti present in a few species; modified scales larger, more conspicuous when present. Most species dull coloured, highly cryptic in appearance; hw not visible when at rest. Females more active and more readily collected than in the Ambulicini. Some species are migratory and very widely distributed. Larvae cylindrical, smooth or granulose, somtimes pubescent, with round heads. Pupae very often with proboscis case prominent, or separated from body. 5 larval instars.

Subtribe ACHERONTIAE
Tribe *Acherontiicae* R. & J. 1903
Type species *Acherontia atropos* L.

This group is characterised by having a hollow protected by a dorsal hair tuft on the inner surface of the second palpal segment.

WORLD DISTRIBUTION OF THE ACHERONTIAE.

	Indo-Australian	*Ethiopian*	*Palaearctic*	*American*	*Total*
Genera	3	4	2	1	5
Species	7	6	2	1	13

There are three widely distributed and one endemic species in Eastern Africa, two of which (*Herse convolvuli* L. and *Acherontia atropos* L.) are not confined to Africa.

Subtribe SPHINGES
Tribe *Sphingini* Grote & Robison 1865
Tribe *Sphingicae* R. & J. 1903
Type species *Sphinx ligustris* L., Europe.

This group includes all the other African species of this tribe. The inner surface of the second palpal segment is not hollowed and there is no hair tuft. Antennae hooked.

WORLD DISTRIBUTION OF THE SPHINGES.

	Indo-Australian	*Ethiopian*	*Palaearctic*	*American*	*Total*
Genera	7	13	2	16	36
Species	10	24	9	85	127

9 genera and 16 species occur in Eastern Africa.

Subtribe SPHINGULI
Tribe *Sphingulicae* R. & J. 1903
Type species *Sphingulus mus* Standinger, Siberia.

A small group of species which link the Acherontiini with the Ambulicini. The second palpal segment is not hollowed, the antennae are not hooked, the proboscis is short, but not rudimentary. The early stages are similar to those of the Ambulicini.

All the species are Asiatic or Australian and R. & J. list 7 genera and 11 species.

Subfamily SEMANOPHORINAE Janse 1932
Division SEMANOPHORAE R. & J. 1903
Type species *Pholus satellitia* Drury, America

This subfamily may be readily separated from the Asemanophorinae by the presence of a patch of sensory hairs at the base of the inner surface of the first palpal segment. Generally speaking, this group is more primitive and uniform than the previous subfamily and the tendency towards structural reduction and loss less evident.

All the species appear to feed on flowers and all have a well developed proboscis, though never of excessive length as in some species of the Acherontiini. The male genital armature is of a simple and very uniform pattern in all the Chaerocampini and in most of the Philampelini, consisting of an undivided uncus and gnathos, entire valve and ventro-proximal harpe, usually with a few large modified scales on the outer surface of the valve. The only exceptions to this rule are the genus *Sphingonaepiopsis* which, although Philampeline in general appearance and structure, has a genital armature which recalls that of the Semanophorinae and the tribe Dilophonotini which has symmetrically divided uncus and gnathos in the more primitive American species, becoming asymmetrical by reduction of the right hand lobes and valves in some of the more advanced genera such as *Cephonodes*. The larvae of the Semanophorinae are seldom granular or pilose and never spiny, and have round heads. In the Philampelini and in the Choerocampini the head is often small and the 5th segment enlarged.

The pupa usually has a projecting, keeled proboscis case in the Choerocampini and Philampelini, but not in the Dilophonotini. The separation of the three tribes which constitute the subfamily Semanophorinae is not clear cut and there are several genera which share characters common to two or more tribes. *Sphingonaepiopsis* has already been discussed and should perhaps be placed near the junction of the Asemanophorinae and Semanophorinae. *Macroglossum* and *Leucostrophus*, although treated as an extreme development of the Philampelini by R. & J. (1903) and thus widely separated from *Cephonodes* and from the American *Aellopos*, the Holoarctic *Haemorrhagia* and the Oriental *Sataspes* share many characters with these genera.

It is possible that some of the characters shared by these widely separated genera are related to the needs of a diurnal existence and have evolved independently in the two tribes.

Tribe DILOPHONOTINI Burmeister 1875
Subfamily *Sesiinae* R. & J. 1903
Tribe *Sesiini* Janse 1932
Type species: *Haemorrhagia* (formerly *Sesia*) *tityus* L. Europe designated by R. & J. 1903.

Mainly an American group which may be separated from the other tribes of the Semanophorinae by the structure of the male genitalia, which usually have divided uncus and gnathos, or are asymmetrical owing to the loss or reduction of one lobe of the uncus and gnathos and of one valve. All the more primitive species which have symmetrical genitalia and approach the Asemanophorinae in several respects were included by R. & J. (1903) in the subtribe Dilophonotae. Many of the more advanced species are diurnal and some are generalised mimics of such bees as *Bombus* and *Xylocopa;* these latter species belong mainly to the Holoarctic genus *Haemorrhagia* and to the Old World genera *Cephonodes* and *Sataspes*, in which the majority of the scales are discarded after emergence, leaving a hyaline wing membrane. As seen earlier, these day flying Dilophonotini have a great number of characters in common with several diurnal genera of Philampelini with which they may be more closely related than R. & J.'s arrangement would suggest.

Subtribe Dilophonotae
Tribe *Dilophonoticae* R. & J. 1903
Type species *Erinnis ello* L., America.

A group of primitive species with crested head, double crested thorax, uniseriate abdominal spines and symmetrical genitalia. These insects have some characters in common with the Acherontiini, and can in fact be regarded as a link between the two subfamilies of the Sphingidae. There are 4 genera and 19 species, all American.

Subtribe Aellopodes
Tribe *Sesiicae* R. & J. 1903
Type species *Haemorrhagia* (formerly *Sesia*) *tityus* L. (Europe.)

Although the type species is not in *Sesia* Fabricius 1775, the tribe was named by R. & J. after that name which was regarded as the oldest generic name in the group. Since then *Sesia* has been applied to a genus in the family Sesiidae (formerly Aegeridae) and can no longer be used in the Sphingidae. The next available name for *Sesia* (Sphingidae) is *Aellopos* Hübner 1822, and the name of the subtribe has been derived from it. An alternative name would have been Haemorrhagiae, but this has not been used, as there are doubts about the validity of *Haemorrhagia* Grote & Robinson 1865, *Haemaris* Dalman 1816 having been rejected by Grote & Robinson and later by Rothschild and Jordan on rather dubious grounds.

All the more advanced species of the tribe including the highly aberrant day-flying genera with strongly asymmetrical genitalia were placed in this subtribe by

R. & J. They share a number of characters with the Philampelini and are in some respects intermediate between them and the Dilophonotae and Acherontiini.

World distribution of the Aellopodes

	Indo-Australian	*Ethiopian*	*Palaearctic*	*American*	*Total*
Genera	3	1	1	18	20
Species	14	5	9	76	101

There is only one species in Eastern Africa.

Tribe PHILAMPELINI Janse 1932
Family *Philampelidae* Burmeister 1878
Subfamily *Philampelinae* R. & J. 1903
Type species: *Pholus satellitia* Drury, America.

A very variable and ill-defined group. Most of its characters have been described under the heading Semanophorinae. The Philampelini may be readily separated from the Dilophonotini by the undivided uncus and gnathos and by the palpi, which are never laterally angular. The genitalia are never asymmetrical and resemble in in most species those of the Choerocampini. The antennae are very variable and so is the spination of tergites and legs. All the species have frenula and retinacula and there is little reduction of the paronychia and pulvilli. The larvae usually taper towards the head which is small and round, but the enlargement of the 5th segment, so typical of the Choerocampini is not so conspicuous. The Philampelini may be readily separated from the Choerocampini by the structure of the bristly appendage (pilifer) at the base of the proboscis, which is single-lobed, never bilobed as in the Choerocampini. The scaleless area at the inner surface of the palpi is absent or reduced, never as large as in the Choerocampini. All the species are believed to feed on flowers; some are strictly crepuscular and seldom attracted to light. Others are diurnal (*Macroglossum* and allied genera) and have a number of important structural characters in common with the Dilophonotini.

Subtribe Philampeli
Tribe *Philampelicae* R. & J. 1903
Type species *Pholus satellitia* Drury, America.

This subtribe comprises the more primitive species of the group. Apical segment of antenna long; abdominal spines in single series; modified scales small and numerous. There is one American genus with 19 species and a second genus with a single species from Hawai.

Subtribe Nepheles
Tribe *Nephelicae* R. & J. 1903
Type species: *Nephele funebris* Fabricius, Africa.

A large group, very varied in appearance, with numerous rather specialised side branches. The diurnal genera bear a striking resemblance to the more specialised Aellopodes. Genitalia of simple structure, very uniform in both sexes and of the same structure as those of the Choerocampini. Modified scales present in most genera, large and few. The genus *Sphingonaepiopsis* is rather aberrant and its male genitalia resemble those of the Asemanophorinae.

World distribution of the Nepheles.

	Indo-Australian	*Ethiopian*	*Palaearctic*	*American*	*Total*
Genera	18	15	9	9	40
Species	106	91	12	16	221

10 genera and 61 species have been recorded from Eastern Africa.

Tribe CHOEROCAMPINI Grote & Robinson 1865
Subfamily *Choerocampinae* R. & J. 1903
Type species: *Pergesa elpenor* L. Europe

A compact, homogeneous group, very closely related to the Philampelini from which they can be separated by the structure of the pilifer and of the palpi.

Pilifer bilobed, the apical part bearing short or vestigial bristles, the proximal part, long bristles. Inner surface and second palpal segment usually naked. Antennae stout, straight, terminally hooked; last segment more of less elongated, armed with 6 or more bristles and dorsally scaleless. Proboscis always well developed. Eyes large, ciliated in some species. Wings elongated, usually with acuminate apices and regular margins. Retinacula and frenula always present. Tibiae always unarmed, paronychia and pulvilli always present. Abdomen elongated and conical. Abdominal spines usually in more than one series at the posterior margin of each somite. Venation uniform and similar to that of the Philampelini. Male genitalia extremely uniform, of the same pattern as in *Nephele*, with large modified scales nearly always present on the external surface of the valve. Female genitalia as in *Nephele*, always with a single elongated longitudinal signum and colliculum.

Larva similar to that of the Philampelini, but anterior tapering more pronounced, 4th and 5th segments more enlarged, horn occasionally lacking in final instar. The larvae are usually decorated with large eye spots, especially on the fifth segment. When they are alarmed they withdraw the head and anterior part of the thorax into the enlarged segments and display the prominent eye spots; they thus acquire a remarkable resemblance to a small snake, an attitude which must be very effective in deterring predators.

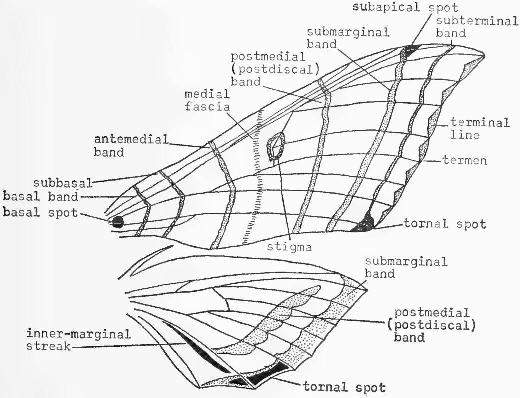
Pupa with a compressed or keeled proboscis case. Medium to large, fast flying, streamlined moths, many of which are crepuscular. The majority of the species feed on flowers and have a wide distribution. Many species have strong migratory tendencies. The more unspecialised species of the group are American.

World distribution of the Choerocampini.	*Indo-Australian*	*Ethiopian*	*Palaearctic*	*American*	*Total*
Genera	7	9	6	3	14
Species	52	43	18	56	157

In Eastern Africa there are 8 genera and 30 species.

In the following revision the more advanced genera within each tribe are treated first, followed by decreasingly specialised species and ending with the most generalised.

Family trees showing the relationship of the genera within each tribe would be desirable, but cannot be attempted without detailed study of all the world genera.



Wing pattern of a Sphingid

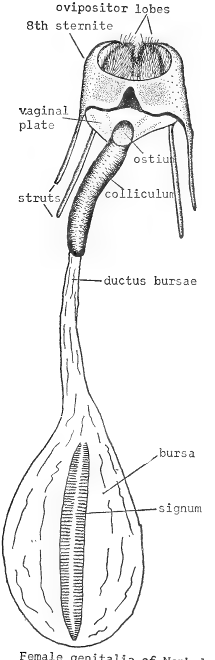
Abbreviations used in the following text

Abbreviations of periodicals and of other publications according to the World List (Third Edition, 1900–1950); abbreviations of works published before 1900 according to Rothschild & Jordan, "A Revision of the family *Sphingidae*", *Novit.zool.* **9** *suppl.;* 1903.

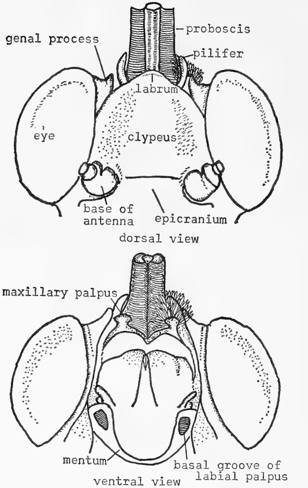
Other abbreviations

B	=	K. Brown collection (Uganda).
BE	=	Berio collection, Genoa, Italy.
BM	=	British Museum collection.
CM	=	Carnegie Museum, Pittsburgh.
comb. nov.	=	new combination.
D.C.	=	discoidal cell.
ESB	=	E.S. Brown collection, Muguga, Kenya.
Fw	=	forewing.
gen. nov.	=	new genus.
GM	=	Museo Civico di Storia Naturale, Genoa, Italy.
H	=	according to Hering in Seitz, "Macrolepidoptera of the World" **14**, 1930.
Ho	=	C. Howard collection, Rhodesia.
Hw	=	hindwing.
K	=	Kawanda Research Station collection, Uganda.
L.	=	Linnaeus.
L	=	Lock collection, Queen Elizabeth National Park, Uganda.
MB	=	Berlin Museum collection.
MC	=	McCleery collection, Lindi, Tanzania.
NM	=	National Museum collection, Nairobi.
nom. nov.	=	new name.
P	=	according to Pinhey in "Hawk Moths of Central and Southern Africa", 1962.
PM	=	Paris Museum collection.
R	=	Robertson collection, Ilonga, Tanzania.
RJ	=	according to Rothschild & Jordan, 1903.
R. & J.	=	Rothschild & Jordan.
S	=	Sevastopulo collection.
SM	=	Stoneham Museum collection, Kitale.
sp. nov.	=	new species.
ssp. nov.	=	new subspecies.
stat. nov.	=	new status.
syn. nov.	=	new synonym.

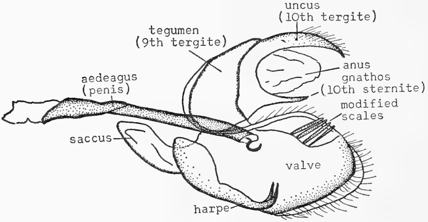
NOTE The colours mentioned in the descriptions of new species are according to Ridgway, "Color Standards and Color Nomenclature", Washington, 1912.



Female genitalia of Nephele
Ventral view



Sphingid head; labial palpi removed



♂ genitalia of Nephele; lateral view

Subfamily ASEMANOPHORINAE

Tribe AMBULICINI

ACANTHOSPHINX Aurivillius 1891

Ent. Tidskr. **12:** 228; type species *Ambulyx guessfeldti* Dewitz, 1879.

Head wide, proboscis short, antennae very thick in ♂. Differs from *Polyptychus* in the absence of spines on the hindtibia and in the much longer tibial spurs.

ACANTHOSPHINX GUESSFELDTI (Dewitz) 1879. (I; 2)

Ambulyx guessfeldti Dewitz *Mitt. munch. ent. Ver.* **3:** 27 (Chinchoxo, Angola, ♂).

1891 *Acanthosphinx guessfeldti* var. *gigas* Aurivillius *Ent. Tidskr.* **12:** 229 (Cameroons, ♂ ♀) syn. nov.

1930 *Acanthosphinx guessfeldti cothina* Tams *Ann. Mag. nat. Hist.* (10) **6:** 167 (N. Rhodesia, ♂) syn. nov.

The Type is an abnormally small specimen and var. *gigas* Aur. is really the normal form. *Cothina* Tams is based on an aberration.

♂: fw, 57–65 mm; apex acute, margin entire, slightly concave, costa convex near apex. Ground colour of wings and body dark purplish grey. Vertex and dorsum of thorax blackish. Two blackish spots before base of abdomen. A small blackish spot on first 3–4 abdominal tergites. Fw with numerous irregular dark lines, and an olive green distal margin. Hw. darker than fw, outer margin olive green. The olive green margins fade to ochreous yellow in old specimens.

♀: larger, wings more rounded. Fw: 70 mm.

HABITAT AND RANGE

Forests from Sierra Leone to the Congo, Angola, Zambia, Malawi, Tanzania and Uganda.

EAST AFRICAN RECORDS

UGANDA	NM	:	Kampala
	B	:	Nakawa
	K	:	Kawanda
	BM	:	Jinja
TANZANIA	NM	:	Bukoba, Kigoma
	BM	:	Uluguru, Ukami
	R	:	Mbimba, near Mbeya
	Ho	:	Amani

LYCOSPHINGIA R. & J. 1903

Novit. zool. **9,** suppl. : 264; type species *Smerinthus hamatus* Dewitz 1879.

Differs from *Polyptychus* in having a single pair of hindtibial spurs, a very weak proboscis and a strongly produced apex to the fw. Genitalia as in *Polyptychus.*

LYCOSPHINGIA HAMATA (Dewitz) 1879. (I; 1)

Smerinthus hanatus Dewitz *Mitt. munch. ent. Ver.* **3:** 28 (Chinchoxo, Angola, ♂).

♂: fw. narrow and long, apex very strongly produced, 29–31 mm. Ground colour pale brown with darker wavy transverse lines and a regularly curved, prominent postmedial line. A dark brown spot at base and another at inner margin near tornus. Some paler mottling at costa near apex. Hw. strongly produced at tornus, darker, with a straight dark medial line and a darker marginal area at tornus.

♀: larger and darker.

GENITALIA: 8th tergite broadly sclerotised, with a median sinus at posterior margin. Post-vaginal plate consisting of two slender, pointed lateral processes meeting mesially, originating from base of anterior struts. Ostium wide, funnel-shaped, with a conical process on either side. Colliculum long, sinuous. Ductus short, wide and saccate, sclerotised, constricted at base of bursa. Bursa rather small and rounded, without signa.

HABITAT AND RANGE

Forests from Liberia and Ghana to Angola, the Congo and Uganda.

EAST AFRICAN RECORDS

UGANDA	BM :	Bwamba (1 ♀ taken by T.H.E. Jackson)
	NM :	Kibale forest
	K :	Kawanda
	B :	Nakawa

LYCOSPHINGIA HOLLANDI Clark 1916.
Proc. New Engl. zool. Cl. **6:** 64 (Cameroons, ♂) Cameroons, Gabon, Congo, Liberia.

POLYPTYCHUS Hübner 1822

Verz. beck. Schmett: 141; type species: *Sphinx dentatus* Cramer, 1777, India.

As defined and conceived by Rothschild and Jordan (*Novit. Zool.* **9** *suppl.*, 1903) and by Hering in Seitz (Macrolepidoptera of the World, **14,** 1930), the genus was a heterogeneous group of some 50 Ethiopian and 2 Asiatic species. The characters given by Rothschild and Jordan are as follows: all tibiae spinose, 2 pairs of hindtibial spurs and presence of pulvilli, paronychia, frenula and retinacula. Rothschild and Jordan saw that it would eventually be necessary to split this large group into several smaller genera, but refrained from doing so because of inadequate knowledge of the group at the time. However, it is felt that enough is known at present to attempt a re-classification of *Polyptychus;* all the known East African species and some others have been studied and compared with the type species—only those that agree closely with *P. dentatus* (Cramer) have been retained in *Polyptychus sensu stricto*, as defined below. *Polyptychus sensu lato* is temporarily retained for the following species which do not occur in Eastern Africa and which have not been available for study; a few other species will be found elsewhere, placed in the genera in which they most probably belong.

POLYPTYCHUS ENODIUS (Holland) 1889.
Basiana enodia Holland *Trans. Amer. ent. Soc.* **16:** 66 (Kangwe, Ogowe, ♀).
1903 *Polyptychus enodia* R. & J. *Novit. zool.* **9** *suppl.:* 247 Gabon and Congo Republic (Brazzaville).

POLYPTYCHUS KINDUNUS Strand 1918.
Int. ent. Z. Guben **12:** 115 (Kindu, east Congo).
Known from the Type only.

The only names available for this group, other than *Polyptychus* Hübner, are *Andriasa* Walker for *contrarius* (Walker) *Pseudoclanis* Rothschild for *postica* (Walker) and related species and *Gynoeryx* Guenée for *meander* Guenée and for four other Madagascar species. *Pseudosmerinthus* Butler and *Dewitzia* Holland cannot be used as they are synonyms of *Andriasa.*

All the species of this group which have been studied in the early stages have larvae with a granular skin; the head may be square or triangular, sometimes prolonged dorso-anteriorly; there are usually 6, occasionally 7 larval instars, the first feeding exclusively on the egg-shell.

POLYPTYCHUS (*Sensu stricto*)

Large to medium sized species, very variable in appearance, some being similar to *Polyptychoides*, others to *Neopolyptychus*, to *Andriasa* and to *Afroclanis*.

Proboscis more or less well developed, rudimentary in *hollandi* and in *paupercula* only. Tibial spurs strong or very strong, never spinose. Antennae fairly slender in both sexes. Uncus acute, blunt, or bilobed. Gnathos always present. Valve single lobed; harpe well developed; aedeagus unarmed, terminating in a reflexed, slender, flexible hook-like process; vesica unarmed, even near base. Bursa of ♀ without signa, except in one specimen from the Congo, which may be the ♀ of *P. nigriplagus* R. & J. and in *P. orthographus* R. & J.

POLYPTYCHUS TRISECTUS Aurivillius 1901. (I; 4)
Ent. Tidskr. **22:** 119 (Congo ♂).

♂ fw. 42–45 mm. strongly acuminate. Light brown, costal area dark brown. Antemedial, postmedial and submarginal lines dark brown, straight. No basal spot; other lines faint and wavy. Stigma prominent, pinkish. Hw brown, paler near tornus. A dark median streak on head and thorax. Proboscis strong and long, tibial spines very long. Underside of body and hw reddish. No black spots or streaks on hw.

FEMALE AND EARLY STAGES: unknown.

HABITAT AND RANGE
Lowland forest from Liberia and Ghana to the Congo and western Uganda.

EAST AFRICAN RECORDS
UGANDA NM : Bwamba.

POLYPTYCHUS ORTHOGRAPHUS R. & J. 1903. (I; 3)
Novit. zool. **9** *suppl.* : 224 (Bopoto, Congo, ♂)

♂: fw. 33–36 mm. Very similar to *P. trisectus* Aur. but smaller, much paler (more ochreous), apex of fw acute, but not produced. Proboscis well developed, tibial spurs normal.

♀: one ♀ in BM., larger, darker and broader winged than ♂.

GENITALIA: post-vaginal plate broad and irregular, fused with lateral arms of ante-vaginal plate, which is part of a very sharply tapering, terminally wide, funnel-like colliculum. Apertures of ostium narrow, shaped like an irregular Y with very wide curving arms. Ductus short and narrow, membranous anteriorly, forming a long sclerotised tube posteriorly. Bursa elongated, pleated, armed with a rather long longitudinal signum before apex. Signum consisting of 2 parallel spinose ridges which meet in a point towards apex of bursa.

HABITAT AND RANGE
Lowland forest from Sierra Leone to the Congo, Angola and Uganda.

EAST AFRICAN RECORDS

UGANDA	NM :	Bwamba
	B :	Mpanga forest
	K :	Kawanda

POLYPTYCHUS BERNARDII Rougeot 1966.
Bull. I.F.A.N. **28**, A.3: 1226 (Gabon, ♂).
Known from Gabon, the Congo (Kinshasa) and from the Central African Republic.

POLYPTYCHUS CARTERI (Butler) 1882. (I; 5,6)
Pseudosmerinthus carteri Butler *Ann. Mag. nat. Hist.* (5) **10:** 435 (Aburi, Gold Coast, ♂).
1903 *Polyptychus carteri* R. & J. *Novit. zool.* **9** *suppl.* : 244 (Sierra Leon ♀).
1906 *Polyptychus poliades* R. & J. *Novit. zool.* **13:** 406 (Ashanti, ♂) syn. nov.

Differs from other species of the group in having a strongly bilobed uncus.
♂: fw. 33–35 mm. Proboscis well developed. Head and body pale greyish brown with a dark median streak on head and thorax. Fw. pale greyish brown; subbasal line well curved distad. post-medial almost straight; other transverse lines very faint and wavy; stigma very small; a very large chocolate coloured spot at base, and another at inner margin, near tornus. Hw. a little darker with two chocolate spots near tornus and sometimes a dark streak near inner margin. In the form *poliades* R. & J., which occurs throughout the range of the species, the ground colour is darker and the dark spots paler, rendering them almost invisible.

♀: larger, darker and broader winged.

RANGE AND HABITAT
Lowland forest from Sierra Leone to the Congo and Uganda.
EAST AFRICAN RECORDS

UGANDA	NM :	Bwamba, Kibale forest, Budongo forest.
	BM :	Entebbe
	B :	Mpanga forest
	K :	Kawanda.

POLYPTYCHUS CORYNDONI R. & J. 1903. (I; 7)
Novit. zool. **9** *suppl.* : 251 (Kazungula, Zambesi ♂).
1911 *Polyptychus reussi* Strand *Dtsch. ent. Z.* 1911: 650.

♂: fw. 34–38 mm. Antennae thicker than in other species of the group. Proboscis well developed, tibial spurs normal. Apex acute; a prominent emargination below apex, remainder of termen convex. Fw grey with rather faint dark transverse lines. A blackish spot near tornus and occasionally traces of basal spots. Hw, brick red, edged with black, except at tornus which is grey. Two black spots near tornus and traces of the inner marginal black streak. Body grey.

♀: fw. 39–43 mm. Wings broader, more rounded than in ♂. Fw and body more brownish than in ♂, sometimes almost cinnamon; antennae more slender.
GENITALIA: vaginal plate not well defined. 8th tergite very narrow, broadening laterally into two plates, each of which gives rise to a very long anterior strut. Operculum trilobed. Ductus short, sclerotised. Bursa spherical, membranous.

HABITAT AND RANGE
Brachystegia woodland from Rhodesia to Malawi, Zambia, Katanga and Tanzania. There is a single record from Northern Nigeria.
EAST AFRICAN RECORDS

TANZANIA	NM :	Ukerewe, Dar es Salaam
	RJ :	Usaramo
	BM :	Pemba
	R :	Mbeya, Mbimba
	MC :	Lindi, Songea
ZAMBIA	NM :	Abercorn

POLYPTYCHUS ANDOSUS (Walker) 1856.
Panacra andosa Walker *List Lep. Het. B.M.* **8:** 159 (Sierra Leone, ♂).

Ssp. *andosus*
Forests from Sierra Leone to Nigeria.

Ssp. *tiro* Kernbach 1957. (P. XI; 2)
Rev. zool. Bot. afr. **55:** 197 (Belgian Congo ♂)

♂: differs from the nominate race in the shape of the harpe, which has one lobe instead of two.
Fw. 26–29 mm. Proboscis shorter than in previous species of *Polpytychus*. Tibial spurs short. Very similar to *coryndoni*, but smaller, termen of fw more regular, body and fw more brownish, transverse lines fainter, more wavy; one or two small basal dots always present. Hw coppery, not as bright as in *coryndoni*. Veins outlined by darker scales, blackish inner marginal streak and tornal spots always present. Antennae more slender than in *P. coryndoni*.

♀: fw. 30 mm., broader, with more convex termen. Body and fw cinnamon brown, markings indistinct. Hw as in ♂, but darker.

RANGE AND HABITAT
Forests from the Congo to Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Fort Portal, Kalinzu, Sango Bay.

Ssp. amaniensis nov. (IX; 9 – XI; 1)
♂: superficially identical with *P. andosus tiro*, but genitalia differ as follows:— process of gnathos shorter and blunter; blades of anellus very much shorter, with toothed inner margins; saccus shorter, tapering suddenly, not spatulate; marginal spine of valve broader, process of harpe narrower.
FEMALE AND EARLY STAGES: unknown.

HOLOTYPE ♂: Amani, E. Usambara, Tanzania, XI–1965, R. H. Carcasson, to be deposited in the British Museum (Natural History).
♂ PARATYPES 5, also from Amani, in National Museum, Nairobi.

POLYPTYCHUS ANOCHUS R. & J. 1906.
Novit. zool. **13:** 179 (Sierra Leone).
Sierra Leone to Nigeria and the Congo.

POLYPTYCHUS LAPIDATUS Joicey & Kaye 1917.
Ann. nat. Hist. **20:** 230 (Coomassie, Gold Coast, ♂).
Liberia to Ghana and Gabon.

POLYPTYCHUS MURINUS Rothschild 1904.
Novit. zool. **11:** 435 (Congo ♂).
Liberia, Nigeria and Cameroons to the Congo and Angola.

POLYPTYCHUS AFFINIS R. & J. 1903. (I; 11)
Novit. zool. **9** *suppl.* : 247 (Lolodorf, Cameroons. ♀).
1907 *Polyptychus retusus* R. & J. *Novit. zool.* **15:** 259 (Sierra Leone. ♂).

♂: fw 28–30 mm. Antennae slender, proboscis rather weak, tibial spurs short. Apex strongly falcate, wing narrow, termen entire, somewhat concave. Fw grey with a prominent black basal spot, and wavy transverse dark lines; termen darker. Body grey with median blackish streak on head and thorax. Hw grey with a black streak near inner margin and one or two black spots near tornus, which is strongly produced.

♀: larger than ♂. Fw purplish chocolate, mottled with lighter brown. Stigma pinkish, transverse lines very faint, basal spot prominent. Dark median streak on head and thorax present. Hw darker than fw, black inner marginal streak and tornal spots present.

HABITAT AND RANGE
Forest up to 6,000 ft. from Sierra Leone to the Congo, Uganda and west Kenya.
EAST AFRICAN RECORDS
KENYA NM : Kakamega.
UGANDA NM : Bwamba, Kibale forest, Mubende, Budongo forest, Kayonza.

POLYPTYCHUS BAXTERI R. & J. 1907.
Novit. zool. **15:** 259 (Mpwapwa, Tanganyika, ♂).

Ssp. *baxteri.* (I; 8)
♂: fw 26 mm. Proboscis rather weak, antennae slender, tibial spurs normal. Apex of fw not acute, termen evenly curved, tornus of hw somewhat produced. Body and fw greyish vinaceous purple. A dark median streak on head and thorax. A dark streak from costa near base to tornus, widening at tornus; a dark spot at costa at 3/5 from base, narrowing at base of vein 6, then continued to termen as a streak below vein 6; a small dark stigma and basal spot sometimes present. Hw pinker, specially near base. Inner marginal streak and tornal spots variable, sometimes almost absent.
♀: larger.

HABITAT AND RANGE
Brachystegia savanna and woodland in Tanzania and Zambia.
EAST AFRICAN RECORDS
TANZANIA NM : Mikumi.
R : Ilonga, Mbimba.
BM : Mamboya, Mpwapwa. (Type, BM).

Ssp. *jansei* Clark 1936.
Polyptychus baxteri jansei Clark *Proc. New Engl. zool. Cl.* **15:** 76 (Queque, S. Rhodesia, ♂).
Rhodesia and western Mozambique.

POLYPTYCHUS FERROSEUS Gehlen 1950.
Ent. Z. **60:** 67 (Elisabethville, Congo, ♂).
Not examined; very probably a synonym of *P. baxteri* R. & J.

POLYPTYCHUS NIGRIPLAGUS R. & J. 1903. (I; 9—IX; 6—XIII; 4)
Novit. zool. **9** *suppl.* : 259 (Lolodorf, Cameroons. ♂).
1926 *Polyptychus nigriplaga kivui* Clark *Proc. New Engl. zool. Cl.* **9:** 48 (west Kivu, Congo, ♂) syn. nov.
1926 *Polyptychus barnsi* Clark *l.c.* **9:** 49 (west Kivu, ♂) syn. nov.

♂: fw 29–36 mm. Antennae slender. Proboscis short and rather weak. Fw not falcate; apex acute, termen entire, slightly, but uniformly convex. Fw and body pale cinnamon to creamy clay. A dark mesial streak on head and thorax. A dark dot at base of fw and one at costa, near apex; wavy transverse lines of fw very variable in intensity, some specimens being almost unmarked (form *barnsi* Clark), others being very heavily marked (form *kivui* Clark). Hw, paler, but darker at tornus. Inner marginal black streak and tornal spots present but variable.

The following is the description of a female in the National Museum taken at Lake Tumba, Kundu, Congo, which may belong to this species, or possibly to an undescribed male.
Fw 33 mm.; apex and tornus more acute that in ♂; a slight emargination below apex, giving remainder of termen greater convexity. Groundcolour russet, darker towards termen. Wavy transverse lines and stigma faint, subapical dot faint, basal dot absent. Hw uniformly russet with dark tornal spots and inner marginal streak present but faint.

GENITALIA: 8th tergite a broad sclerotised arc with a median suture of more membranous tissue. Sternite broad and wide, with slight median sinus at ostium—Ductus broad and funnel shaped tapering to a membranous constriction followed by a narrow sclerotised tube. Bursa fairly large, spherical, membranous. One large transverse signum consisting of 2 long parallel serrated ridges and a small signum consisting of a single pear shaped serrated plate.

HABITAT AND RANGE
Lowland forest from Liberia and the Ivory Coast to the Congo and Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Bwamba, Budongo.

POLYPTYCHUS ROUGEOTI sp. nov. (IX; 8—XI; 3)

Closely allied to *P. nigriplagus* R. & J.
♂: antennae very pale greyish brown. Head olive-ocher, palpi isabella colour. Proboscis moderately well developed. Tegulae very pale greyish brown, dorsum of thorax olive-ocher. Dorsum of abdomen very pale greyish brown, with a diffuse ochreous transverse, band on second tergite, and olive-ocher tip. Underside of thorax and abdomen wood brown without trace of olive. Femora wood brown, tibiae and tarsi tinged with olive. A whitish spot at the base of the tibiae.

UPPERSIDE

FOREWING: long and narrow, apex acute, outer margin oblique, very slightly concave, 35 mm from base to apex. Ground colour wood brown, mottled with olive yellow at costa, inner margin and in the subapical area. A large dark olive basal spot, and a paler olive spot at inner margin $\frac{1}{3}$ from base, and a triangular olive spot at costa, before apex. Subbasal, antemedial and postmedial olive, irregular and strongly crenulated. A small bright orange stigma at end of cell. Terminal area very pale greyish brown, submarginal line indicated by a double series of dark dots at the veins, except near tornus where it becomes a short double dark olive line. Termen and cilia wood brown.

HINDWING: wood brown, paler at tornus, where there is a dark brown spot. A long brown streak parallel to inner margin. Cilia very pale grey, darker at the veins. Tornus somewhat produced.

UNDERSIDE

FOREWING: wood brown, much paler towards outer margin. Submarginal double, regularly crenulated, subterginal consisting of a straight, complete series of double dots at the veins; Termen and cilia darker.
HINDWING: similar to fw, but with a dark, regularly crenulated median line.

GENITALIA: uncus moderately long, only slightly downcurved, slightly spatulate, terminating in two sharp points separated by a median sinus. Gnathos very long, slender, apically pointed. Saccus narrow,

pointed. Valve rather narrow, apically rounded. Ventro-apical arm of harpe abruptly truncated; upper arm of harpe a smooth concave, apically rounded process directed upwards and to the rear. Aedeagus short, fairly straight and slender. Hook-like process curved laterad, with a small basal emargination and a very small rounded subapical lobe immediately before the sharply curved apical spine. Base of aedeagus dilated and terminating in a long sharply tapering lobe. Ventral aspect armed apically with numerous small but prominent tubercles.
♀ and early stages unknown.

HOLOTYPE ♂: Lastourville, Gabon, P. C. Rougeot, 1–1958, to be deposited in the Muséum National d'Histoire Naturelle, Paris.
PARATYPES: 3 ♂ ♂, same data as Holotype, one in the National Museum, Nairobi, one in the Muséum National, Paris and one in the British Museum (Natural History).
This species is dedicated to its discoverer, Dr. P. C. Rougeot, of the Muséum National d'Histoire Naturelle, Paris.

POLYPTYCHUS PAUPERCULUS (Holland) 1889. (I; 10)
Dewitzia paupercula Holland *Trans. Amer. ent. Soc.* **16:** 65 (Kangwe, Ogowe River).
1912 *Polyptychus inconspicuus* Strand *Arch. Naturgesch.* **78:** A: 151 (Cameroons ♀).

♂: fw 27–31 mm. Proboscis very weak. Antennae slender. Wings broader, less acuminate than other species, very similar in shape and markings to *Andriasa contraria* Walker. Fw pale greyish-brown, with numerous crenulate darker transverse lines, more or less parallel. A darker spot near apex and another at inner margin, near tornus. A large rounded orange brown basal dot. Hw pale greyish-brown, margin darker, especially near tornus, with traces of an inner marginal streak.
♀: larger, darker, broader winged than ♂.

HABITAT AND RANGE
Forest from Liberia to Uganda.
EAST AFRICAN RECORDS
UGANDA BM : Entebbe.

POLYPTYCHUS HOLLANDI R. & J. 1903.
Novit. zool. **9** *suppl.:* 261 (Warri, Nigeria, ♂).
Almost identical with *P. pauperculus* Holland, but the genital armature differs.
Forests from Nigeria to the Congo.

NEOPOLYPTYCHUS gen. nov.

A small compact group of species which differ from *Polyptychus* mainly in the structure of the male genitalia.
Antennae slender. Proboscis reduced, but not rudimentary. Tibial spurs normal, not spiny. Apex of aedeagus armed with a whorl of spines, but without hook-like process; a small sclerotised plate near base of vesica. Gnathos absent, saccus small, harpe absent. Valve with dorsal margin produced into a prominent and well sclerotised lobe. Bursa of female without signa.
Males grey to pinkish-grey, apices acute, wing margins never scalloped or dentate. Females larger, broader winged, dark brown to cinnamon. The species of this group are very similar and confusing; all of them have a basal dot on fw, a black streak near inner margin of hw and one or two black spots at tornus. They cannot be determined with certainty without dissection of the genitalia.*
TYPE SPECIES: *Polyptychus convexus* R. & J. 1903.

NEOPOLYPTYCHUS PYGARGUS (Karsch) 1891 comb. nov.
Dewitzia pygarga Karsch *Ent. Nachr.* **17:** 295 (Barombi, Cameroons, ♀).
1903 *Polyptychus pygarga* R. & J. *Novit. zool.* **9** *suppl.:* 245.
1929 *Polyptychus pygarga pygarga* Jordan *Novit. zool.* **35:** 188 (Victoria, Cameroons, ♂).

Ssp. *pygargus.*
Forest in Cameroons and Nigeria.

Ssp. *spurrelli* (R. & J.) 1912.
Polyptychus spurrelli R. & J. *Novit. zool.* **19:** 128 (Bibianaha, Gold Coast, ♂).
1929 *Polyptychus pygarga spurrelli* Jordan *Novit. zool.* **35:** 188.
Of doubtful validity, as it only differs from the nominate race in minor genitalial characters of uncertain stability.
Ghana to Sierra Leone.

NEOPOLYPTYCHUS SERRATOR (Jordan) 1929, comb. nov.
Polyptychus serrator Jordan *Novit. zool.* **35:** 188 (Cameroons, ♂).

Ssp. *serrator.*
Only known from Cameroon.

*For further details about this group see: "On *Polyptychus pygarga* and some allied species" by K. Jordan, *Novit. zool.* **35:** 187, 1929.

Ss. *commodus* (Jordan) 1930. (I; 12—IX; 7—XI; 4—XII; 7)
Polyptychus serrator commodus Jordan *Novit. zool.* **36:** 1 (Bugalla, Sesse Islands, Uganda, ♂).

♂: fw 34–36 mm., grey, with faint irregular wavy dark lines, a prominent black dot at base and a round pinkish stigma, paler at apex. Termen darker. Hw grey with a black streak near inner margin and one or two black spots near tornus which is strongly produced—Antennae grey.

♀: (not previously described.)
Head and body purple-brown, antennae paler, palpi and legs darker. Fw. 38 mm, more falcate than in ♂. Groundcolour purple-brown, with very faint wavy transverse lines and pinkish mottling. A dark brown wedge at costa, just before apex. A broad subtriangular paler patch with base resting on termen from apex to vein 2. Pinkish stigma very prominent. Cilia dark brown. Hw pinkish-brown at inner margin and tornus, remainder brown, darker than fw. Black streak and tornal spots present, but inconspicuous. Cilia pinkish except near tornus, where they are black.

UNDERSIDE: Fw. dark cinnamon brown with faint transverse lines. Submarginal area of fw paler, termen and cilia of fw dark brown. Hw brighter with a diffuse dark area and blackish cilia at tornus.

GENITALIA: vaginal plate well sclerotised; anterior margin with two lateral, reflexed triangular processes. 8th tergite with deep median sinus at posterior margin. Ductus fairly long, funnel-shaped, well sclerotised. Bursa ovoid, thick, but membranous.

NEALLOTYPE ♀ Uganda, Mpanga R/P 392 20-VI-60
K. W. Brown, bred ex *Maesopsis emini* Engl.
(Rhamnaceae) B1226, to be deposited in British Museum (Natural History).

EARLY STAGES: (after D. G. Sevastopulo).
MATURE LARVA: head triangular, green, speckled with white. A bright green dorsal stripe with raised

white spots broadening from a point behind head to the 10th somite, then tapering to base of horn. A double white dorsal line. Green dorsal stripe edged laterally with white. Lateral areas below dorsal stripe pale lilac then pale blue-green. A series of oblique whitish lines from 4th to 11th somites. Legs pinkish. Venter and prolegs blue-green, a median white ventral line. Horn slightly downcurved, blue-green with a few minute ventral tubercles.

PUPA: subterranean in cell formed by pressure only, without silk threads. Bright chestnut, cremaster a blunt triangle.
FOOD PLANT: *Maesopsis eminii* Engl. (Rhamnaceae)

HABITAT AND RANGE
Forests from the Congo to Uganda and W. Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Fort Portal, Kalinzu, Makerere, Budongo.
	BM :	Jinja.
	B :	Mpanga, Nyabyeya.
	K :	Kampala, Kawanda.
TANZANIA	BM :	Bukoba.

NOTE: the females of *P. pygargus* and *P. serrator* are identical and it is therefore possible that Jordan associated the wrong ♂ with the ♀ type of *pygargus;* the males can only be separated by the presence of a lobe with spiny margins at the dorsal margin of the valve, which is replaced in *serrator* by a smooth gradual bulge.

NEOPOLYPTYCHUS CONVEXUS (R. & J.) 1903 comb. nov. (I; 15,16—XI; 5)
Polyptychus pygarga convexus R. & J. *Novit. zool.* **9** *suppl.* : 246 (M'pala, Tanganyika, ♀).
1934 *Polyptychus pygarga convexus* Gehlen *Ent. Z.* **48:** 59 (♂).
1936 *Polyptychus springerae* Clark *Proc. New Engl. zool. Cl.* **15:** 78 (Likasi, Congo, ♂) syn. nov.

♂: fw. 26–34 mm., less falcate than in *serrator*, termen slightly convex. Very similar to *serrator* and *pygargus*, but pinker, more heavily marked and with a larger, much more prominent stigma.

♀: (not examined). Very similar to the ♀ of *serrator*, but paler, more pinkish, with a much more convex margin (after R. & J. 1903, 346 and P1.1, fig. 8).

HABITAT AND GENERAL DISTRIBUTION
Brachystegia woodland in Katanga, Zambia and west Tanzania.
EAST AFRICAN RECORDS

ZAMBIA	NM :	Abercorn.
	BM :	Kalambo Falls.
TANZANIA	NM :	Mukuyu (Kigoma).
	R :	Tabora.

NEOPOLYPTYCHUS CONSIMILIS (R. & J.) 1903, comb. nov.
Polyptychus consimilis R. & J. *Novit. zool.* **9** *suppl.* : 250 (Atbara, Sudan, ♂).
1927 *Polyptychus consimilis belgica* Clark *Proc. New Engl. zool. Cl.* **9:** 46 (French Congo, ♂).
1927 *Polyptychus sudanensis* Clark *l.c.* : 100 (Tembura, Bahr el Ghazal, Sudan, ♂).
Ssp. *consimilis*. (I; 13)

♂: fw 30 mm. Apex of fw much more falcate than in other species of this genus. Body and wings pale pinkish-brown with faint transverse bands and stigma. Underside pinkish.
FEMALE AND EARLY STAGES: unknown.

RANGE AND HABITAT
Savanna from the southern Sudan to the Congo.
EAST AFRICAN RECORDS

SUDAN	BM :	Atbara River (Type).
	CM :	Tembura, Bahr el Ghazal, Sudan (Type of *sudanensis* Clark).

Ssp. *ancylus* R. & J. 1916.
Novit. zool. **23**: 258 (Gambaja, Gold Coast, ♂).
Nigeria to the Ivory Coast and Guinea.

NEOPOLYPTYCHUS PRIONITES (R. & J.) 1916, comb. nov. (I; 14—XI; 7)
Polyptychus prionites R. & J. *Novit. zool.* **23**: 258 ("Upper Shari", ♂).
1917 *Polyptychus roseola* Clark *Proc. New Engl. zool. Cl.* **6**: 63 (French Congo, ♂).

♂: fw 30 mm. Similar to *N. consimilis*, but fw less falcate, groundcolour darker, more vinaceous on both surfaces. Form *roseola* Clark is a pale pinkish dry form.

♀: similar to ♂, but darker, wings more rounded.

RANGE AND HABITAT
Lowland forest and heavy woodland from Spanish Guinea to the Congo and western Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Budongo, Nyabyeya.

NEOPOLYPTYCHUS COMPAR (R. & J.) 1903 comb. nov.
Polyptychus compar R. & J. *Novit. zool.* **9** *suppl.* : 251 (Mashonaland, Rhodesia, ♂).

Ssp. *compar*. (I; 17,18—XI; 6)
A variable race, some specimens much pinker than others.
♂: can be separated from *N. convexus* R. & J. by the antennae which are consistently whitish, not grey or pinkish as in *convexus* and by the structure of the genitalia.

♀: similar to that of *convexus*, but possibly paler; fw cinnamon with very faint darker lines and a pale stigma; basal spot absent. Hw much paler.

RANGE AND HABITAT
Brachystegia woodland from Rhodesia to Mozambique, Zambia, Malawi and south-east Tanzania.
EAST AFRICAN RECORDS

TANZANIA	MC :	Lindi.
	NM :	Mbimba.

Ssp. septentrionalis, nov. (IX; 5)
♂: differs from the nominate race in being consistently greyer (never pinkish), in the more acuminate fw and in having a slightly broader and shorter uncus. Very similar superficially to *N. serrator*, but slightly smaller, more heavily marked and with whitish, not grey antennae.
FEMALE AND EARLY STAGES: unknown.

RANGE: coastal areas of Kenya and north Tanzania.

EAST AFRICAN RECORDS

KENYA	NM :	Kilifi, Shimba Hills, Shimo la tewa.
TANZANIA	NM :	Amani.
	R :	Ilonga, Mlingano.

HOLOTYPE ♂: Amani, E. Usambara, Tanzania, XI-1965, R. H. Carcasson, to be deposited in the British Museum (Natural History).

♂ PARATYPES: 3, same data as *Holotype*.
3, locality as *Holotype*, VII-1966, A. Duff-Mackay and A. Forbes-Watson.
4, Shimba Hills, Kenya Coast, XII-1961, R. H. Carcasson.

PARATYPES: in National Museum, Nairobi.

POLYPTYCHOPSIS gen. nov.

Proboscis rudimentary. Antennae slender. Tibial spurs spinose. Wings broad, apex not falcate, margin entire. Genitalia as in *Polyptychus*, but hook-like process of aedeagus absent.
TYPE SPECIES: *Polyptychus marshalli* R. & J., 1903.

POLYPTYCHOPSIS MARSHALLI (R. & J.) 1903, comb. nov.
Polyptychus marshalli R. & J. *Novit. zool.* **9** *suppl.* : 253 (Salisbury, Rhodesia, ♂).

Ssp. *marshalli*. (II; 1—XII; 10)
♂: fw 26–30 mm. Fw brownish pink, with a number of rather faint, fairly straight darker transverse lines. In some specimens a large, diffuse orange spot at base. Hw darker, unmarked: darker at the termen. Fw broad, as in previous species.

♀: larger; termen of fw slightly produced at veins 5 and 6.

HABITAT AND RANGE
Brachystegia woodland from Rhodesia to Malawi and south-east Tanzania.

EAST AFRICAN RECORDS

TANZANIA NM : Tunduma.

Ssp. *auriguttata* (Gehlen) 1934, comb. nov. (XI; 10)
Polyptychus auriguttatus Gehlen, *Ent. Z.* **48**: 59 (Elisabethville, Katanga).
Differs from the nominate race in being darker, more vinaceous.

RANGE
Katanga, south-west Tanzania and probably eastern Angola.

EAST AFRICAN RECORDS

ZAMBIA NM : Abercorn.

POLYPTYCHOIDES gen. nov.

Proboscis rudimentary. Antennae very thick in the males. Wing margin deeply scalloped. Tergites spiny. Tibial spurs unarmed. Valve entire, harpe present; gnathos present. Aedeagus unarmed.
TYPE SPECIES: *Smerinthus grayi* Walker 1856.

POLYPTYCHOIDES GRAYI (Walker) 1856, comb. nov.
Smerinthus grayi Walker *List Lep. Het. B.M.* **8**: 249 (Natal).
1903 *Polyptychus grayi* R. & J. *Novit. zool.* **9** *suppl.* : 241.
Common and widespread in dry bush and savanna from South Africa to Ethiopia and the Sudan.

Ssp. *grayi*. (XI; 8)
Natal to Rhodesia.

Ssp. *assimilis* (R. & J.) 1903.
Polyptychus grayi assimilis R. & J. *Novit. zool.* **9** *suppl.* : 242 (Rietfontein, S. W. Africa, ♀).
Cape to S.W. Africa and Botswana.

Ssp. *niloticus* (Jordan) 1920.
Polyptychus grayi niloticus Jordan *Novit. zool.* **28:** 277 (White Nile, ♀). (II; 2,3—XIII; 1)
1935 *Polyptychus unilineata* Clark *Proc. New Engl. zool. Cl.* **15:** 20 (Karunga, Kisumu, Kenya, ♂) syn. nov.

This race is subject to considerable seasonal and climatic variation. Extreme dry season specimens and specimens from arid areas are very small, sandy, with all markings faint or obsolete and more regular wing margins. Specimens from moister areas, or taken in the wet season are consistently larger, darker grey, more heavily marked and have scalloped wing margins. Both forms may occur in the same areas, have identical genital armatures and are linked by complete transitional series.

♂: fw 28–43 mm., falcate and scalloped in wet season form (*unilineata*). Antennae pale yellowish, very thick. Ground colour grey with a black basal dot in fw. Antemedial, postmedial and submarginal lines of fw straight and clearly defined; medial faint and wavy; a further faint and wavy line between postmedial and submarginal lines; a dark grey marginal area from apex to vein 2 and a very small stigma. Hw grey, darker near inner margin, with postmedial and submarginal lines regular, but faint. In the extreme dry form (*nilotica*) the ground colour is pale sandy; only the antemedial, postmedial and submarginal lines of fw are visible and the dark marginal area very slighly indicated; basal spots absent or very faint.

GENITALIA: uncus short, broad, rounded apically. Gnathos consisting of two long, narrow, pointed processes. Anellus also armed with two long pointed blades. Saccus very small. Valve triangular, membranous. Harpe ventro-distal, terminating in a sharp stout hook directed inwards; there is a stout triangular process at margin of harpe, before terminal hook; in the nominate race this subterminal process is consistently lacking; aedeagus long and very slender.

♀: larger and more rounded than ♂, otherwise similar in both forms. Fw, 34–52 mm.

RANGE: Zambia to the Sudan, Ethiopia and Somalia.
EAST AFRICAN RECORDS

KENYA	NM :	Tiwi (Mombasa), Makueni, Mtito Andei, Melka Murri (Mandera), Merti (NFD), Isiolo, Lokichoggio (NFD), Loiongalani (L. Rudolf), Kibwezi, Thomson's Falls, Nakuru.
	CM :	Karunga (Type of *Polyptychus unilineata* Clark.
TANZANIA	NM :	Lyamungu.
	BM :	Amani, Tabora, Shinyanga.
	ESB :	Manyara.
	R :	Dar es Salaam, Ilonga, Mlingano, Ukiriguru.
ETHIOPIA	NM :	Dire Dawa, Bongozi (Omo River).
	BM :	Harar.
SUDAN	BM :	White Nile (Type).
SOMALIA	NM :	Mogadishu.

POLYPTYCHOIDES DIGITATUS (Karsch) 1891 comb. nov. (II; 4)
Polyptychus digitatus Karsch *Ent. Nachr.* **17:** 14 (Chinchoxo, Angola).

1879 *Smerinthus dentatus* Dewitz *Mitt. munch. ent. Ver.* **1:** 27 (preoccupied by *Sphinx dentatus* Cramer, 1777, India).
NOTE: *dentatus* Dewitz 1879 could be re-instated under *Polyptychoides*, but as *digitatus* Karsch has been in use since 1891, it is not advisable to do so.

♂: fw. 39–41 mm. Very similar to *L. grayi*, but consistently darker; basal spot of fw replaced by a short transverse streak.
GENITALIA: uncus short, broad, bilobed. Gnathos consisting of two pointed arms. Saccus moderate, rounded. Valve large, rounded. Harpe triangular, extended by a long apical process which reaches apex of valve; dorsal margin of harpe armed with a large basal hook and two blunt spines near middle. Aedeagus slender, slightly curved.

♀: similar to ♂, but larger, with broader wings.
GENITALIA: vaginal plate armed with two subtriangular processes with multi-grooved distal edges. (After Kernbach. *Rev. Zool. Bot. afr.* **55:** 18).

HABITAT AND RANGE
Heavy forest up to 8,000ft., from Liberia and Angola to Uganda and west Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Elgon, Kakamega.
UGANDA	NM :	Bwamba, Kalinzu forest, Kibale forest, Budongo.
	K :	Kawanda.

POLYPTYCHOIDES EROSUS (Jordan) 1923 comb. nov. (II; 5)
Polyptychus erosus Jordan *Ent. Mill.* **12:** 54 (Mt. Meru, Tanganyika, ♂).
Very similar to *P. digitatus* Karsch, but slightly paler and broader winged.

♂: fw. 35–41 mm.
GENITALIA: similar to *P. digitatus*, but harpe longer and more slender, unarmed; a comb of dense minute teeth along the entire dorsal margin of the harpe.

♀: fw. 53 mm.; similar to ♂, but wings broader, margins less crenulated.
GENITALIA: 8th tergite broadly sclerotised, posterior margin with irregular median sinus. Ante-vaginal plate transverse, narrow and irregular in outline. Post-vaginal plate membranous. Ostium large, irregularly rounded. Colliculum absent, ductus fairly long, without sclerotised collar. Bursa small, rounded, very thin and unarmed.

HABITAT AND RANGE
Highland forest in Kenya and Tanzania, east of the Rift Valley.
EAST AFRICAN RECORDS

KENYA	NM :	Nairobi, Muguga.
TANZANIA	NM :	Arusha, Mbimba.
	BM :	Amani, Mt. Meru (Type).

NOTE: *P. erosus* is very closely related to *P. digitatus* and occupies the same habitat as that species; the two species are allopatric, and have therefore been treated as subspecies by some authors. However, the genitalial differences of the males are such that one is compelled to treat these two insects as distinct, though very closely related species.

GYNOERYX Guenée 1865

in Vins., *Voy. Madag.* : 30; type species *Gynoeryx meander* Guenée, 1865.

Very closely allied to the Oriental and Palaearctic genus *Marumba* Moore, but differs in having two pairs of tibial spurs. Antennae thick in ♂. Proboscis rudimentary. Tibial spurs short, not spinose. Wings broad, margins crenulated, apices blunt. Markings as in *Marumba*. Uncus bifid. Harpe large, with an articulated terminal flap armed with sharp spines. Aedeagus unarmed, but vesica with a large sclerotised plate. The genus is only known from Madagascar.

GYNOERYX MEANDER Guenée 1865. (XI; 11)
in Vins. *Voy. Madag.* : 30; (nomen nudum).
1875 *Smerinthus meander* Boisduval *Spec. Gen. Lep. Het.* **1:** 22 (Madagascar, ♀).
1903 *Polyptychus meander* R. & J. *Novit. zool.* **9** *suppl.* : 262.

GYNOERYX BREVIS (Oberthür) 1909 comb. nov.
Polyptychus brevis Oberthür *Bull Soc. ent. Fr.* : 233 (Madagascar, ♂).

GYNOERYX BILINEATUS (Griveaud) 1958 comb. nov.
Polyptychus bilineatus Griveaud *Nat. Malgache* **10:** 77 (Madagascar, ♂).

GYNOERYX PAULIANI (Viette) 1956 comb. nov.
Polyptychus pauliani Viette *Lambillionea* **56,** 78: 59 (Madagascar, ♂).

GYNOERYX INTEGER (Viette) 1956 comb. nov.
Polyptychus integer Viette *Lambillionea* **56,** 78: 59 (Madagascar, ♂).

PSEUDOCLANIS Rothschild 1894

Novit. zool. **1:** 96; type species: *Basiana postica* Walker 1856.
1954 *Larunda* Kernbach *Rev. zool. Bot. afr.* **50:** 218; type species: *L. sororia* Kernbach 1954.

Antennae fasciculate, tapering, slender. Palpi protruding very slightly beyond frons. Proboscis very short. Tibiae spinose, hindtibiae armed with two pairs of spurs. Fw somewhat falcate, termen entire. ♂ genitalia without modified scales. Aedeagus unarmed. Larva with 6 instars.

PSEUDOCLANIS GRANDIDIERI (Mabille) 1879.
Ambulyx grandidieri Mabille *Bull. Soc. philom. Paris* **3:** 135 (S.E. Madagascar).
1884 *Ambulyx watersi* Butler *Ann. Mag. nat. Hist.* **14:** 407 (Betsileo, Madagascar).
1900 *Psedosmerinthus semnus* Karsch *Ent. Nachr.* **26:** 370 (West Madagascar).

Ssp. *grandidieri*.
Madagascar.

Ssp. *comorana* R. & J. 1916 *Nov. zool.* **23:** 254.
Comoro Islands.

PSEUDOCLANIS POSTICA (Walker) 1856. (II; 6)
Basiana postica Walker *List. Lep. Ins. B.M.* **8:** 237 (Natal).
Common in most habitats throughout Africa south of the Sahara.

Ssp. *postica.*
1857 *Smerinthus abyssinicus* Lucas *Ann. Soc. ent. Fr.* : 606 (Khartoum, ♀).
1883 *Smerinthus bianchii* Oberthür *Ann Mus Stor. nat. Genova* **18:** 734 (Shoa, Abyssinia, ♀).
1903 *Pseudoclanis postica abyssinicus* R. & J. *Novit. zool.* **9** *suppl.* : 222 syn. nov.
1928 *Pseudoclanis grandidieri kenyae* Clark *Proc. New Engl. zool. Cl.* **10:** 45 (Kibwezi, Kenya, ♂) syn. nov.

♂: fw fairly broad, 40–45 mm. from base to apex, very pale greenish to yellowish brown, faintly marked and mottled with darker brown. Hw ochreous yellow with a large black spot at base and a series of submarginal black spots sometimes confluent and forming a continuous black band.

♀: larger, wings more rounded, fw darker, often reddish.

EAST AFRICAN RECORDS

KENYA	NM :	Kitale, Nairobi, Makueni, Nyeri, Kilifi.
	S :	Istsare.
	DGS :	Mombasa.
UGANDA	B :	Jinja, Nakawa, Nyabyeya.
	K :	Kawanda.
TANZANIA	NM :	Amani, Mufindi, Ukerewe.
	R :	Ilonga, Mbeya, Mlingano.
	MC :	Lindi, Songea.
SUDAN	BM :	Didinga.
	RJ :	Khartoum.
ETHIOPIA	NM :	Dire Dawa, Bongozi (Omo River).
	RJ :	Shoa.
	BM :	Harar.
SOMALIA	GM :	"Somalia".

NOTE: East African specimens and particularly those from Uganda, are transitional to ssp. *occidentalis* R. & J., which should be regarded as the western extreme of a cline rather than as a good subspecies.

Ssp. *occidentalis* R. & J. 1903.
Pseudoclanis postica occidentalis R. & J. *Nov. zool.* **9:** 222 (Sierra Leone, ♂).
In the ♂ the margin is straight, not convex; harpe processes more heavily sclerotised and more strongly developed. (See note above). Sierra Leone to the Congo.

Ssp. *diana* (Gehlen) 1922.
Pseudoclanis diana Gehlen *Int. ent. Zeitschr.* **16:** 104 (Windhuk, ♀)
Based on minor characters of the genitalia. South West-Africa.

Ssp. *evestigata* Kernbach 1955.
Rev. Zool. Bot. afr. **51:** 30 (Elisabethville. ♂)
Based on minor characters of the male genitalia. Katanga (Congo).

PSEUDOCLANIS BOISDUVALI (Aurivillius) 1897 comb. nov.
Temnora boisduvali Aurivillius *Ent. Tidskr.* **18:** 152 (Sierra Leone).
1903 *Polyptychus boisduvali* R. & J. *Novit. zool.* **9** *suppl.* : 249.
1920 *Polyptychus senegalensis* Clark *Proc. New Engl. zool. Cl.* **7:** 69 (Senegal).
Dry bush from Senegal to northern Nigeria.

PSEUDOCLANIS RHADAMISTUS (Fabricius) 1781 comb. nov. (II; 8)
Sphinx rhadamistus Fabricius *Mant. Ins.* **2:** 93 (Sierra Leone).
Polyptychus rhadamistus R. & J. 1903 *Novit. zool.* **9** *suppl.* : 248.

♂: fw. 27–30 mm. Thorax silvery grey with a prominent blackish median line. 1st abdominal segment blackish, remainder of abdomen mottled grey. A black dot near tip of abdomen. Fw narrow, apex acute, termen entire, silvery grey, greenish in some specimens. A black basal dot and a dark grey spot at apex. A straight thick black line from inner margin near base to middle of vein 5, thence bending proximad to costa at $\frac{1}{5}$ from apex. Area between straight line and inner margin dark grey as far as middle of vein 5 and tornus. A few dark dots in submarginal area and a black spot at inner margin. Hw strongly produced at tornis, dark greyish brown; a blackish patch near inner margin and a crenulate black submarginal line surmounted by a pale fascia from inner margin to just beyond vein 2.

♀: differs in having a larger apical spot on fw.
GENITALIA: 8th tergite sclerotised, with posterior margin evenly rounded. Post-vaginal plate consisting of a short, narrow transverse projecting plate, flanked on either side by a deep irregular sinus followed by a similar latero-ventral plate. Ostium produced into a very short, narrow operculum. Antevaginal plate consisting of a narrow, antero-posteriorly compressed ring, open anteriorly, where there is a small tongue-shaped median plate. Colliculum absent, but replaced by the slightly sclerotised posterior portion of the ductus which is at a sharp angle to the ostium and to the remainder of the ductus. Ductus fairly long and slender. Bursa small rounded, minutely pitted, unarmed.

HABITAT AND RANGE
Lowland forest and heavy woodland from Senegal to Angola, the Congo and western Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Bwamba.

PSEUDOCLANIS MOLITRIX (R. & J.) 1917 comb. nov.
Polyptychus molitor R. & J. *Novit. zool.* **19:** 132 (Benue, Nigeria ♀).
1954 *Larunda sororia* Kernbach *Rev. Zool. Bot. afr.* **50:** 218. (Congo ♀)

RANGE AND HABITAT
Open savanna and arid areas throughout tropical Africa.

Ssp. *molitrix*. (II; 7)
♂: fw. 30–32 mm. Apex and tornus acute, outer margin straight. Very pale creamy buff with four straight darker lines, the antemedial parallel to the subbasal and the postmedial to the submarginal— No stigma. Hw produced at tornus, pale creamy buff with traces of 2 straight transverse lines. A darker dorsal line on thorax.

♀: larger, more rounded, not examined.

RANGE
Senegal to the Sudan and Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Bwamba.
SUDAN BM : Darfur.

Ssp. *subviridis* (Joicey & Talbot) 1932.
Polyptychus molitor subviridis Joicey & Talbot *Bull. Hill Museum* **4:** 178. (Burao, British Somaliland ♀).
Larger and more greenish than the nominate race; doubtfully distinct from the following race.
Somalia and Arabia.

Ssp. *lauta* (Jordan) 1920.
Polyptychus molitor lautus Jordan *Novit. zool.* **27:** 167 (Barberton, Transvaal, ♀).
Larger and more heavily marked than typical race. Genitalia of ♂ as in typical race.

RANGE
Tanzania to Rhodesia and the Transvaal.
EAST AFRICAN RECORDS

TANZANIA	NM	:	Ukiruguru.
	MC	:	Lindi, Songea.

MICROCLANIS gen. nov.

Proboscis vestigial. Antennae very thick in male. Abdominal tergites spiny. Tibial spurs not spiny. Aedeagus and vesica unarmed. Valve entire, harpe vestigial. Vein 6 of fw arises beyond cell, on a common stalk with 7 and 8. Veins 6 and 7 of hw on a long stalk.
TYPE SPECIES: *Polyptychus erlangeri* R. & J. 1903.

MICROCLANIS ERLANGERI (R. & J.) 1903 comb. nov. (II; 9,10—XI; 9—XII; 11)
Polyptychus erlangeri R. & J. *Novit. zool.* **9** *suppl.* : 810 (Dahele, Somalia, ♂).

A small grey species.
♂: fw 23–26 mm. Apex acute, margin slightly crenulate, and convex; pale grey, datker at inner and outer margins, but not at tornus. 3 fairly regular well defined transverse lines; a minute black dot at base and 2 or 3 larger black dots at inner margin, near tornus. Hw paler, with 2 faint darker transverse lines and traces of a dark spot at tornus.

GENITALIA: uncus slender, rounded apically. Lobes of gnathos fused, forming a tongue-shaped shelf. Saccus long and slender, valve membranous, rounded. Harpe ventral, bent, bilobed at base. Vesica covered with minute tubercles at base.
♀: fw 25–30 mm. Generally larger, darker, more indistinctly marked, wings more rounded.
GENITALIA: vaginal plate consisting of an arc posterior to ostium and with 7 transverse folds at centre. Ductus very short. Bursa membranous.
EARLY STAGES: unknown.

HABITAT AND RANGE
Arid bush from central Tanzania to eastern and northern Kenya, Ethiopia and Somalia.
EAST AFRICAN RECORDS

KENYA	NM	:	Athi River, Voi, Mtito Andei, Ijara, Kuranze, Merti (NFD), Loiyongalani (L. Rudolf), Watamu, Malindi, Wajir.
	BM	:	Ngong escarpment, Makindu.
TANZANIA	NM	:	Singida, L. Manyara.
ETHIOPIA	BM	:	Gorgoru, Daroli.
SOMALIA	NM	:	Mogadishu.
	BM	:	Dahele (Type).

NOTE: specimens from Watamu and Malindi, on the Kenya coast are darker, with more crenulate but less convex margins and may constitute a wet season form, or possibly belong to an undescribed species. The only male available has a more slender uncus and reduced lobes at the base of the aedeagus.

CHLOROCLANIS gen. nov.

Proboscis weak. Antennae slender. Abdominal tergites spinose. Tibial spurs short, not spinose. Aedeagus armed with a subapical spine. Uncus undivided. Gnathos bilobed, harpe well developed.
TYPE SPECIES: *Pseudosmerinthus virescens* Butler, 1882.

CHLOROCLANIS VIRESCENS (Butler) 1882 comb. nov.
Pseudosmerinthus virescens Butler *Ann. Mag. nat. Hist.* (5) **10:** 435 (Aburi, Ghana, ♂).
1903 *Polyptychus virescens* R. & J. *Novit. zool.* **9** *suppl.* : 243.
1917 *Polyptchus olivolinea* Joicey & Kaye *Ann. nat. Hist.* **20:** 308 (Bitye Ja river, Cameroons ♀) syn. nov.
1951 *Polyptychus virescens ochracea* Gehlen *Rev. Zool. Bot. afr.* **44:** 251 (Punia Lubutu, Congo, ♂) syn. nov.

Ssp. *virescens.*
♂: fw 28–30 mm. Apex acute, termen straight. Fw, head and thorax rather bright greyish green. Forewing mottled with lighter grey green and faintly marked with numerous wavy transverse lines. Antemedial straighter, darker and thicker than remainder. Subbasal spots and stigma faint or absent. Hw not produced at tornus, ground colour paler than fw, green tinge confined to marginal area. Medial and postmedial bands vaguely indicated. A dark grey suffusion from inner margin to base and to termen at vein 2. Underside yellowish green, with darker crenulate transverse bands in both wings. Abdomen paler than thorax, excepting 2nd and 3rd tergites, which are darker. A beautiful insect when fresh, but fades very quickly to a dirty pale ochreous yellow, specially if relaxed in a moist medium.

P. virescens ochracea Gehlen is merely a badly faded male from the Congo.
GENITALIA: uncus short, broad at base, tapering very suddenly to a downcurved point. Gnathos consisting of 2 long, narrow, pointed lateral blades. Anellus armed with two sharp upright spines. Saccus short, broad and rounded. Valve entire, rounded, membranous, ventro-distal margin armed with irregular tubercles. Harpe occupying basal half of valve and terminating in a large, strong, smooth, sharp, upturned ventral spine. Aedeagus short and straight, apically rounded, armed with a strong pointed subapical process directed upwards and at right angles to the axis of the aedeagus. No modified scales.

♀: (See following subspecies) Larger, longer winged, apex of fw strongly accuminate. Ground colour of both wings and body a very dark olive, markings at in the ♂.
EARLY STAGES: Unknown.

HABITAT AND RANGE
Forest, from West Africa to Angola, the Congo, Uganda and West Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Fort Portal, Katera, Kampala, Mabira, Bwamba, Budongo forest.
	B :	Nakawa.

Ssp. **tanzanica** nov. (IX; 1,2—XI; 12—XII; 3)
♂: similar to typical race, but with tegulae and pronotum very dark olive green, and 2 dark olive green spots near middle of inner margin of fw. These dark areas are so prominent that they persist even in badly faded specimens.
GENITALIA: uncus more slender than in nominate race. Lateral lobes of gnathos much shorter and more slender.

♀: as in nominate race, but more prominently marked.
GENITALIA: 8th sternite broad, with a blunt median projection distad and numerous parallel transverse folds beyond ostium. Operculum an evenly curved projecting plate. Ductus short and strongly sclerotised but not fluted. Bursa membranous, pear-shaped. Signa absent.
EARLY STAGES: unknown.

HOLOTYPE ♂: Amani, E. Usambara, Tanzania, XI-1965, R. H. Carcasson, to be deposited in British Museum (Natural History).

ALLOTYPE ♀: Locality as above. VI-1964, G. Pringle (No. P1098) Genitalial preparation SP542.
♂ PARATYPES: 2, same data as *Holotype*.
2, same locality as *Holotype* (G. Pringle and "Amani Biological Institute").
1, Moshi, Tanganyika, III-1950, N. P. Mitton.
1, Arusha, Tanganyika, VII-1958, A. Rydon.
ALLOTYPE and PARATYPES in National Museum, Nairobi.

FALCATULA gen. nov.

Antennal pectinations short in both sexes. Proboscis rudimentary. Tibial spurs spinose. Valve bilobed, or, as in *F. cymatodes* R. & J. the well sclerotised upper lobe fused with the lower lobe. Harpe absent, aedeagus unarmed, but terminating in a sharp point. Type species: *Polyptychus falcatus* R. & J. 1903.

FALCATULA CYMATODES (R. & J.) 1912 comb. nov. (II; 15)
Polyptychus cymatodes R. & J. *Novit. zool.* **19**: 130 (S. NIGERIA, ♂).

♂: fw very falcate with slightly crenulate margin and sharp, angular tornus, 28–32 mm. Olive grey with indistinct, narrow, wavy transverse lines, a very small dark stigma and a very prominent blackish spot at base. Hw grey with indistinct postmedial and subterminal lines, more clearly visible at tornus. Tornus strongly produced.

♀: fw. 34–38 mm. Costa more strongly curved near apex, tornus of hw less strongly produced. Ground colour darker than in ♂, transverse lines heavier and more conspicuous.
GENITALIA: 8th Sternite consisting of a well sclerotised V-shaped plate proximal to short operculum and surmounted by 2 evenly curved lobes which converge towards operculum. Anterior struts very short and curved. Ductus short and membranous; bursa small and membranous.
EARLY STAGES: unknown.

HABITAT AND RANGE
Lowland forests from Ghana to western Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Bwamba, Kibale Forest, Budongo.

FALCATULA FALCATA (R. & J.) 1903 comb. nov. (II; 14—XII; 6)
Polyptychus falcatus R. & J. *Novit. zool.* **9** *suppl.* : 247 (Salisbury, Rhodesia, ♀).

♂: very similar to *P. cymatodes*, but a good deal paler, and with more regular and distinct transverse lines in both wings. 2 basal dots on each fw. smaller and paler. Shape and length of fw similar to *P. cymatodes*.
GENITALIA: uncus long, downcurved with a terminal hook. Gnathos consisting of 2 short broad plates, with upturned inner edges almost meeting. Saccus long, broad and rounded, Valve bilobed, consisting of a strongly sclerotised, very slender, long pointed upper lobe, and a broad, rounded, membranous lower lobe, sclerotised at base and ventral margin, which is armed with a single short spine. Aedeagus short, straight and pointed.

♀: larger and darker, with more strongly curved costa near apex and slight emargination below apex. Hw tornus not produced. Fw 38–42 mm.
GENITALIA: ostium flanked by a pair of very prominent projecting plates armed with 3 or 4 stout spines. 8th tergite with median sinus. Two concave oval plates immediately before ostium. Ductus very short; bursa spongy, very small, reflexed distad.

HABITAT AND RANGE

Savanna and woodland from Rhodesia to Malawi, Mozambique, Zambia, Katanga and East Africa; also recorded from Spanish Guinea. A common species.

EAST AFRICAN RECORDS

KENYA	NM :	Isiolo, Kitale, Ruiru, Shimba Hills, Kericho, Gazi.
	BM :	S. Kavirondo, Elgon, Mombasa, Rabai.
UGANDA	NM :	Fort Portal, Mubende, Budongo.
	BM :	Kampala.
	B :	Nakawa.
	K :	Kawanda.
TANZANIA	NM :	Kigoma, Amani, Tengeru, Ilonga.
	R :	Dar es Salaam, Mbeya, Mlingano, Tabora,
	MC :	Lindi, Songea.

Polyptychus penumbra Clark 1936. *Proc. New Engl. zool. Cl.* **15:** 78, based on a ♂ from Katanga, is probably no more than a dark form of *Falcatula falcata*.

FALCATULA TAMSI sp. nov. (IX; 3—XVII; 6)

Very closely allied to *F. falcata* R. & J., but fw much less falcate, basal dots almost absent, and uncus and upper lobe of valve very much shorter. Possibly a very distinct race.

MALE

Proboscis rudimentary. Antennae, head and body uniformly pale greyish yellow. Femora pale greyish yellow, tibiae and tarsi a little darker. A prominent white spot at base of mid and hind tibiae.

UPPERSIDE

FOREWING: 33 mm from base to apex. Apex very slightly falcate, tornus angular and slightly produced, outer margin almost straight. Ground colour pale greyish-yellow, darker at termen. Two very small faint basal dots. Grey subbasal line faint. Antemedial grey, double, sharply angled distad in cell. Medial line double and well defined. Stigma small and extremely faint. A faint, very wavy postmedial line, better defined at costa. Subterminal vaguely indicated by nervular spots. Terminal area darker from apex to vein 3. A faint darker spot at tornus. Cilia a little darker than ground colour, especially at the veins and distal margin.

HINDWING: indented at the margin, slightly produced at tornus. Ground colour as in fw, marginal area darker. Median line double, well defined, much straighter than in *F. falcata*. Postmedial very wavy, subterminal indicated by nervular dots.

UNDERSIDE

Ground colour pale greyish yellow. Basal spots, subbasal and antemedial lines and stigmata absent in both wings. Four wavy, parallel dark lines from costa to inner margin beyond end of cell. A short dark streak from subterminal to apex of fw. These lines are more strongly crenulate in hw than in fw. Third line from base incomplete in hw.

GENITALIA: uncus short, broad-based tapering evenly to a down curved blunt point. Gnathos consisting of a narrow sclerotised belt with a median groove where the downcurved edges of the two lobes meet. Saccus broad and rounded, shorter than in *F. falcata*. Valve bilobed, the upper lobe long, slender, curved and pointed, not reaching beyond basal quarter of uncus. Lower lobe membranous apically, sclerotised at base and ventral margin, with a spine at ventral margin. Harpe absent. Aedeagus fairly short, terminating in a slightly downcurved point.

HOLOTYPE ♂: Abyssinia, Harar, 15-VI-39, R. E. Ellison, BM 1960–550, in British Museum (Natural History).

This species which is only known from the Holotype, is dedicated to Mr. W. H. T. Tams of the British Museum.

ANDRIASA Walker 1856

List Lep. Het. B.M. **7:** 1735. Type species: *Andriasa contraria* Walker 1856.
1882 *Pseudosmerinthus* Butler.
1893 *Dewitzia* Holland.

Proboscis very short. Palpi small. Antennae slender. Tibial spurs well developed, spinose. Abdominal tergites spinose all over. Wings broad. Genital armature of male unlike any other species; aedeagus and vesica unarmed, modified scales absent. Bursa of female without signa. Only 5 larval instars.

ANDRIASA CONTRARIA Walker 1856.
List Lep. Het. B.M. **7:** 1735 (Natal, ♂).
1882 *Pseudosmerinthus marginalis* Butler. *Ann. Mag. nat. Hist.* (5) **10:** 435 (♂).
1903 *Polyptychus contraria* R. & J. *Novit. zool.* **9** *suppl.* : 257.
1911 *Trotonotus crenulata* Bethune-Baker, *Ann. Mag. nat. Hist.* (8) **7:** 558 (Angola).
1912 *Polyptychus objectus* Strand *Arch. Naturgesch.* **78** (A): 151 (♂).
1935 *Polyptychus towadeus* Gehlen *Ent. Z.* **49:** 12 (Elisabethville) syn. nov.
1950 *Polyptychus stigmaticus* Gehlen *Ent. Z.* **60:** 67 (Nyeri, Kenya, ♂) syn. nov.

A very variable species; common in all habitats except deserts and high mountains throughout Africa south of the Sahara.

Ssp. *contraria*. (II; 11,12—XI; 15)
♂: fw 25–31 mm., short and broad, margin entire, apex acute, but not produced. Ground colour of fw and body very pale buff to yellowish grey, to reddish buff. Numerous irregular crenulate lines, almost absent in some specimens, very conspicuous in others. Two minute basal dots present in some specimens. Stigma obsolete to large and black (form *stigmatica* Gehlen). Hw rounded, usually paler than fw, often with a reddish tinge; medial and submarginal lines crenulate and usually present, sometimes a series of small subterminal black dots at the veins, joined into a short line at the tornus.

♀: larger, wings longer and narrower, apex of fw strongly acuminate. Markings similar to ♂ and just as variable, but ground colour darker, reddish buff to dark reddish brown. Hw paler, as in ♂.

RANGE

South Africa to Tanzania, East Africa and Ethiopia.

EAST AFRICAN RECORDS

KENYA	NM :	Nairobi, Diani, Fort Hall, Ruiru, Kapenguria.
	S :	Mombasa.
TANZANIA	NM :	Amani, Mufindi.
	R :	Dar es Salaam, Ilonga, Mlingano.
	MC :	Lindi, Songea.
ETHIOPIA	NM :	Neghelli.

Ssp. *submarginalis* (Walker) 1864.
Basiana submarginalis Walker, *List. Lep. Het. B.M.* **31:** 37 (Sierra Leone, ♀).
1869 *Basiana suffusa* Walker, *Proc. nat. Hist. Soc. Glasgow* **1:** 329 (Congo).
1875 *Smerinthus adansoniae* Boisduval, *Spec. Gen. Lep. Het.* **1:** 27 (Senegal).
1879 *Smerinthus pechueli* Dewitz, *Mitt. munch. ent. Ver.* **3:** 28 (Chinchoxo, Angola).
1893 *Dewitzia perpallida* Holland, *Ent. News* **4:** 341 (Benita, Gabon).

A subspecies of doubtful validity. The ♂ is said to have a straighter termen than the nominate race; such males, however, occur amongst typical males at Amani and at the coast. The females appear to be more distinct, being smaller, darker, particularly in the hw and narrower winged. There are no structural differences.

RANGE: West Africa to the Congo, Uganda and west Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kaimosi, Mt. Elgon.
UGANDA	NM :	Tororo, Kagera, Kalinzu, Kibale Forest. Bwamba, Budongo Forest, Impenetrable Forest (Kigezi).
	SM :	Bombo.
	S :	Kampala.
	B :	Mpanga forest, Nakawa.

Ssp, *diffusa* (R. & J.) 1910.
Novit. zool. **17**: 456 (Ghinda, Eritrea, ♂).

Markings in both wings above and below almost absent in both sexes.
Known from the Type and from a female from the same locality, both in the British Museum (Natural History).

RUFOCLANIS gen. nov.

Proboscis weak, not reaching further than end of thorax. Tibial spurs spinose. Male genitalia comparatively simple; apex of aedeagus or base of vesica armed with a varying number of spines. Valve entire, harpe present. Uncus spatulate or pointed, never bifid. Outline of wings more or less crenulate. Forewing brown or grey with numerous wavy transverse lines. Hindwing pink or brown. Females similar to males, but larger. Bursa of female without signa. Type species: *Triptogon rosea* Druce 1882.

RUFOCLANIS JANSEI (Vari) 1964 comb. nov.
Polyptychus jansei Vari *Koedoe* **7**: 45 (Pafuri, Transvaal ♂). Transvaal and Rhodesia.

RUFOCLANIS FULGURANS (R. & J.) 1903 comb. nov. (II; 17—XIII;2)
Polyptychus fulgurans R. & J. *Novit. zool.* **9** *suppl.* : 254 (Kiokwe, B.E.A. ♂).

♂: fw. 22–32 mm. Internervular indentations at the margin present, but not pronounced. Fw apex acute, slightly falcate. Fw pale pinkish brown with a well defined non-crenulate dark medial line, more or less parallel to termen. Basal, subbasal, postmedial and subterminal lines wavy and much less clearly defined. Two small dark dots at base, sometimes merging into a single elongated dot. Hw pink with two prominent dark reddish brown spots near tornus. A dark median line on vertex and dorsum of thorax.

♀: very similar to ♂, but larger. Fw 40 mm.
GENITALIA: 8th tergite consisting of a broad transverse band with irregularly sinuous posterior edge. 8th sternite consisting of a narrow straight edged sclerotised band produced laterally into two prominent lobes projecting distad. A short, narrow operculum; 1st pair of struts very short. Ductus wide, short, well sclerotised. Bursa ovoid, membranous.

HABITAT AND RANGE

Dry savanna and bush from Rhodesia to Tanzania and eastern Kenya.

EAST AFRICAN RECORDS

KENYA	BM	:	Kiokwe. (Type)
TANZANIA	NM	:	Ilonga.
	R	:	Dar es Salaam, Mlingano, Ukiriguru.
	BM	:	Pigawasi, Amani.
	MC	:	Lindi, Songea.

RUFOCLANIS MACCLEERYI sp. nov. (IX; 4—XVII; 2)

Very closely allied to *P. fulgurans* R. & J., but differs in the more falcate, less crenulate fw, the much larger brown basal spot in fw, the reduction of the pink colour in the hw to a basal patch, and in the structure of the ♂ genitalia.

♂ ANTENNAE: pale pinkish-buff.

HEAD: frons and vetex pale pinkish buff, crest darker. 1st and 2nd segment of palpi sayal brown, third segment pale pinkish buff.

THORAX: light pinkish cinnamon above, with a median brown streak continued from vertex, but not reaching base of abdomen; below sayal brown, becoming paler and pinker towards base of abdomen.

ABDOMEN: light pinkish buff above and below.

LEGS: femora cinnamon, tibiae and tarsi paler internally, darker externally; a whitish external spot at base of mid and hind tibiae.

UPPERSIDE

FOREWING: more elongated than in other species of the group, 32 mm from base to apex. Apex acute and falcate, tornus strongly produced, termen only very weakly crenulate. Ground colour light pinkish cinnamon, sprinkled with brown scales, darker beyond medial line. A large, irregular warm sepia spot at base. Subbasal line brown, single, narrow, fairly straight, bending distad at cubitus. Antemedial double, enclosing slightly darker ground colour, very irregular, sharply angled distad at the anal vein, proximad at the base of vein 2, and distad at cubitus. Stigma consisting of two narrow, parallel lines close together and slightly curved proximad, from vein 3 to radius. Medial line much thicker than all others, dark brown, accompanied distally by a similar though narrower parallel line, almost straight from just beyond middle of inner margin to costa at $\frac{2}{3}$ from base. Ground colour beyond medial darker, warmer, except at costa and tornus. Three irregular, wavy more or less parallel lines from inner margin to costa, all of them bending sharply distad near apex, the subterminal with a branch from vein 6 to apex. Vein 5 and 6 outlined in warm sepia. Marginal area from apex to vein 2, brown. Cilia warm sepia, edged distally with cinnamon.

HINDWING: ground colour more reddish than fw, a large terra cotta area at base. Marginal area somewhat darker. Tornal angle which is rather produced, pale pinkish buff. Veins outlined by darker scales. 2 irregular, but sharply defined warm sepia spots near tornus, the inner one surmounted by a small brown patch with ill-defined margins. Medial line straight but faint, postmedial also faint, crenulate.

UNDERSIDE

FOREWING: groundcolour of basal half terra cotta, remainder cinnamon. Subbasal and antemedial absent, medial very faint, Postmedial, subterminal and terminal more regular and better defined than above. A dark brown triangle at apex and terminal area from apex to vein 2 light pinkish cinnamon. Cilia paler than above.

HINDWING: light pinkish cinnamon from base to medial, which is straight and well defined. Postdiscal and marginal areas cinnamon; postmedial, subterminal and terminal lines parallel, somewhat wavy, but clearly defined. Cilia brown.

GENITALIA: similar to *P. fulgurans* R. & J., but uncus very blunt, with a very slight median indentation at apex. Arms of gnathos slender but shorter. Valve longer and narrower, somewhat lobed apically and without blunt ventrodistal hook. Aedeagus very similar to *R. fulgurans*, but armed apically with two rounded lobes, not 2 blunt spines.
FEMALE: unknown.

HOLOTYPE ♂: Lindi, S.E. Tanganyika, 9-III-1965, C. H. McCleery, to be deposited in British Museum (Natural History).
This species is known from the Holotype only and is dedicated to its discoverer, Dr. C. M. McCleery.

RUFOCLANIS ROSEA (Druce) 1882 comb. nov.
Triptogon rosea Druce *Ent. mon. Mag.* **19:** 17 (Cameroons ♀).
1891 *Triptogon reducta* Karsch *Ent. Nachr.* **17:** 13 (Togo, ♂).
1903 *Polypytchus rosea* R. & J. *Novit. zool.* **9** *suppl.* : 256.
1936 *Polyptychus rosea orientalis* Clark *Proc. New. Engl. zool. Cl.* **15:** 77 (Kolokani, Sudan, ♂) syn. nov.

Ssp. *meloui* Oberthür 1913 (*Etud. Lep. comp.* **9:** 133) described from Senegal is probably an extreme dry season form.

Ssp. *rosea.* (II; 16)
♂: fw. 30–32 mm., margin crenulate, apex not falcate; very pale olive brown with distinct narrow dark transverse lines, a dark dot at base and one near tornus. Termen sometimes darker. Hw much brighter pink than foregoing species, with the usual dark spots at tornus. 1st and 2nd abdominal tergite dark olive brown. Antennae more prominently fasciculate than other species of group.
GENITALIA: similar to *P. fugurans* R. & J., but arms of gnathos much shorter and broader, lobes of subscaphium larger. Ventro-distal hook not so pronounced. End of aedeagus armed with a single short, broad-based hook.

♀: slightly larger, with more rounded wings.
GENITALIA: vaginal plate consisting of a triangular central portion immediately posterior to ostium and of two bilobed lateral segments. Ductus short, well sclerotised. Bursa pear shaped.
EARLY STAGES: unknown.
HABITAT AND RANGE
Forests from Sierra Leone to the Congo, Angola and Uganda.

EAST AFRICAN RECORDS

UGANDA	NM :	Entebbe, Budongo.
	B :	Nyabyeya.
	K :	Namulumba (Singo), Kolungi (Mengo).

RUFOCLANIS NUMOSAE (Wallengren) 1860 comb. nov.
Smerinthus numosae Wallengren *Wien. ent. Mon.* **4:** 42 (Caffraria, ♀).
1882 *Triptogon cytis* Druce *Ent. mon. Mag.* **19:** 18 (Vaal River, S. Africa, ♀).
1899 *Polyptychus consanguineus* Distant *Ann. Mag. nat. Hist.* (7) **3:** 179 (Lydenburg, South Africa, ♀).
1903 *Polyptychus numosae* R. & J. *Novit. zool.* **9** *suppl.* : 256.
1961 *Polyptychus hesperus* R. & J. *Novit. zool.* **23:** 260 (Tsumeb, S.W. Africa, ♂) syn. nov.
Ssp. *numosae*.

HABITAT AND RANGE
Dry bush and arid savanna from the eastern Cape to Rhodesia, Bechuanaland and South-West Africa.
There is a pale form (typical) and a darker form (*hesperus* R. & J.) similar to northern subspecies *subjecta* Walker in appearance, which occur together throughout most of the range of the subspecies; these forms are probably climatic and seasonal.

Ssp. *subjecta* (Walker) 1869 stat. nov. (II; 13)
Smerinthus subjectus Walker *Proc. nat. Hist. Soc. Glasgow* **1:** 328 (Congo, ♂).
1903 *Polyptychus fumosus* R. & J. *Novit. zool.* **9** *suppl.* : 254 (Dar es Salaam, ♂) syn. nov.
1915 *Polyptychus fumosus pelops* Fawcett *Proc. zool. Soc. Lond.* **9:** 107 (Kedai, Kenya).
Differs from the nominate race in the shape of the harpe.

♂: fw. 22–30 mm. Marginal indentations regular and pronounced in both wings. Apex acute, but not falcate. Greyish pinkish brown to light brown with an evenly curved oblique postmedial line in fw and numerous dark wavy lines in hw. A faint dark spot at base of fw and a prominent reniform stigma. Two dark spots at tornus of hw.
GENITALIA: uncus short and spoon-shaped. Gnathos armed with a median, pointed projection. Funnel of aedeagus long and pointed. Valve rounded, armed with minute tubercles at distal margin. Harpe ventro-distal, consisting of a triangular plate and a stout hook. Aedeagus short and straight terminating in a sub-globular projection covered in minute spines. In ssp. *numosae* the valve is shorter, more rounded, the marginal tubercles cover a greater area and the harpe is much smaller.

♀: fw. 34–36 mm. Similar to ♂, but darker, apex of fw slightly falcate.
GENITALIA: 8th sternite consisting of a narrow sclerotised band, strongly sinuate distad beyond ostium and of two anterior, almost circular plates, one on each side of ostium. Ostium prolonged into a short, bisinuate operculum. Ductus sclerotised, short and wide, bursa ovoid, membranous.
EARLY STAGES: not known.

RANGE
Kenya, Tanzania, Zambia, Angola, S. Congo. Habitat as above.
EAST AFRICAN RECORDS

KENYA	NM :	Mtito Andei, Makueni, Ruiru, Kisigau (Voi), Kilifi.
	BM :	Kedai.
	S :	Mombasa.
TANZANIA	NM :	Dodoma.
	S :	Gaita.
	R :	Dar es Salaam, Ilonga, Mlingano.

RUFOCLANIS ERLANGERI (R. & J.) 1903 comb. nov. (II; 18)
Odontosida erlangeri R. & J. *Novit. zool.* **9** *suppl.* : 811 (Webi Maki, Somalia, ♂).
Known from the type only.

Similar to *P. numosae*, but smaller and greyer, with a much better defined postdiscal band in hw.
GENITALIA: a complete description is not possible from the remaining fragments of Jordan's dry preparation. Uncus spoon-shaped, more slender than in *numosae*. Harpe similar to *numosae*, but much larger. Aedeagus similar to *numosae*, but incomplete.
EARLY STAGES: unknown.

AFROSPHINX gen. nov.

Antennae slender in both sexes. Proboscis rudimentary. Tibial spurs weak, not spinose. Margins of wings entire; vein 6 of fw not stalked; veins 6 and 7 of hw have a common origin, but are not stalked. Aedeagus with a short fixed apical hook. Uncus and gnathos undivided, harpe weak.
TYPE SPECIES: *Polyptychus amabilis* Jordan 1911.

AFROSPHINX AMABILIS (Jordan) 1911 comb. nov.
Polyptychus amabilis Jordan *Novit. zool.* **18:** 135 ("Belgian Congo", probably Katanga, ♂).

Ssp. *amabilis*. (XII; 9)
♂: fw. 30–32 mm. Head, body and fw red to orange brown speckled with brown. Two curved, oblique, parallel antemedial lines. Postmedial double near costa, evenly curved before vein 2, then bending distad before reaching inner margin. Submarginal also double at costa, then single and crenulate. A diffuse ochreous orange discal patch and a similar, but smaller area at apex. Hw redder at base, more densely speckled with brown with a blackish suffusion near inner margin and tornus.

♀: much redder, with discal markings paler.
♀ GENITALIA: (typical race) Post-vaginal plate irregularly sclerotised, with a lateral triangular flap projecting on either side of ostium. Anterior margin of ostium irregularly dentate. Colliculum absent, but represented by two lightly sclerotised semicircular plates at posterior end of ductus. Ductus very long and slender. Bursa very small, rugose, unarmed.

HABITAT AND RANGE
Brachystegia woodland in Katanga, Angola and Zambia.

Ssp. *occidens* (Clark) 1927 (II; 19—XVII; 5)
Polyptychus amabilis occidens Clark *Proc. New Engl. zool. Cl.* **9:** 32 (Sasahila, near Igandu station, east of Dodoma, Tanganyika, ♂).
♂: darker and more brick coloured than nominate race and with reduced pale areas.
GENITALIA: uncus long, with a short terminal hook and a slight constriction near base. Gnathos a prominent but blunt pointed plate; anellus provided with two minutely rugose rounded plates. Saccus very long and narrow, dilated into a round apical lobe. Valve elongated, with well rounded apex. Harpe a longitudinal ridge ending in a densely spinose rounded subapical lobe. Aedeagus stout and straight, terminating in a short, broad, downcurved hook. Genitalia as in nominate race.

FEMALE AND EARLY STAGES: unknown.

Known only from the *Holotype* in the Carnegie Museum, Pittsburgh and from a ♂ *Cotype* from the same locality in the British Museum (Nat. Hist), London.

PSEUDANDRIASA gen. Nov.

Antennae slender in both sexes: proboscis reduced to two very weak short lobes. Tibial spurs not spinose. Wings very rounded. Abdominal spines at posterior margins of tergites only. Uncus bilobed, gnathos crescent-shaped. Harpe absent. aedeagus short, unarmed.
TYPE SPECIES: *Lymantria*? *mutata* Walker 1855.

PSEUDANDRIASA MUTATA (Walker) 1855 comb. nov. (XI; 17)
Lymatria ? mutata Walker *List Lep. Het. B.M.* **16:** 873 (Natal)
1862 *Andriasa erubescens* Walker *Trans. ent. Soc. Lond.* (3) **1:** 263 (Natal, ♂).
1903 *Polyptychus mutata* R. & J. *Novit. zool.* **9** *suppl.* : 262 Apparently confined to South Africa.

MALGASSOCLANIS gen. nov.

Probably related to the Oriental genus *Clanidopsis* R. & J. Antennae slender, proboscis well developed. Wings rounded. Legs very slender, tibial spurs not spinose. Uncus broad, undivided, or bifid near apex. Harpe absent. Aedeagus unarmed, or with a short, fixed, apical hook.
TYPE SPECIES: *Polyptychus delicatus* Jordan 1921. Two species, both confined to Madagascar.

MALGASSOCLANIS DELICATA (Jordan) 1921 comb. nov. (XI; 14)
Polyptychus delicatus Jordan *Novit. zool.* **28:** 278 (Madagascar, ♂)

MALGASSOCLANIS SUFFUSCA (Griveaud) 1958 comb. nov.
Polyptychus suffuscus Griveaud *Nat. Malgache* **10:** 77 (Madagascar, ♂).

BATOCNEMA R. & J. 1903

Novit. zool. **9** *suppl.* : 190; type species: *Ambulyx cocquereli* Boisduval 1875.
Proboscis short, just extending beyond base of abdomen. Antennae slender, fasciculate, terminating in a tuft of scales. Foretibia armed with a stout apical thorn, otherwise tibiae spineless. Tibial spurs unequal. Paronychia bilobed. Abdominal tergites not spinose. Venation as in *Polyptychus;* apex of fw truncated; tornus of both wings strongly produced.

BATOCNEMA AFRICANA (distant) 1899. (II; 20)
Polyptychus africanus Distant *Ann. Mag. nat. Hist.* (7) **3:** 179 (Lydenburg, Transvaal, ♂).

♂: fw. 30–33 mm. Head and body pale green, tegulae and first abdominal tergite dark green. Fw. pale yellowish green shot with pink and mottled with darker green and yellow. A large dark green inner marginal spot at base, a dark green wedge-shaped spot at costa at $\frac{1}{4}$ from base and a large quadrate dark green spot at apex. Hw yellow with green border and dark green spot at tornus.

♀: similar to ♂, but slightly larger; fw, 35 mm.
GENITALIA: 8th tergite very lightly sclerotised, mesially incised. 8th sternite with posterior edge narrowly sclerotised laterally, broadening into a transversally rugose broad plate before ostium. Ductus very long with a short colliculum. Bursa small, rounded, membranous. Struts long and slender.

HABITAT AND RANGE
Open woodland and savanna from South Africa to Rhodesia, Tanzania and the Kenya coast.
EAST AFRICAN RECORDS

KENYA	NM :	Tiwi.
TANZANIA	R :	Dar es Salaam, Ilonga, Mlingano.
	MC :	Lindi, Songea.
	RJ :	Ukami.

BATOCNEMA COCQUERELI (Boisduval) 1875.
Ambulyx cocquereli Boisduval *Spec. Gen. Lep. Het.* **1:** 191 (Nossi-be, Madagascar).

Ssp. *cocquereli.*
RANGE: Madagascar.

Ssp. *comorana* R. & J. 1903.
Novit. zool. **9** *suppl.* : 191 (Comoro Islands).

Ssp. *aldabrensis* Aurivillius 1909.
Voeltzkow, Reise in Ostafrica: **2:** 334 (Aldabra Island).

RHADINOPASA Druce 1880

Ent. mon. Mag. **26:** 268; type species: *Rhadinopasa hornimani* Druce 1880.
1892 *Rhadinopsis* Kirby *Cat. Lep. Het.* **1:** 674.
Proboscis short and weak. A tuft of long hair scales behind eye. Antennae slender, tapering, slightly fasciculate. Palpi long, but not projecting. Abdominal tergites densely spinose; terminal spine of foretibia absent; tibiae not spinose, tibial spurs unequal. Tarsi long and slender. Apex of fw truncated; veins 6 and 7 of hw on a short stalk. Male genitalia without modified scales.
Larva spinose with round head and short horn.

RHADINOPASA HORNIMANI Druce 1880.
loc. cit. (Cameroons, ♂).
1889 *Basiana hornimanni* Holland *Trans. Amer. ent. Soc.* **16:** 66 (♀).
1891 *Rhadinopasa udei* Karsch *Ent. Nachr.* **17:** 14 (Ashanti, ♀).

Ssp. *hornimani.*
A large species.
♂: fw 65 mm. Head and body pale orange brown. Fw pale orange brown to pale olive with a number of faint, wavy, parallel subbasal lines and a narrow dark longitudinal streak from costa at $\frac{1}{3}$ from base to proximity of outer margin. Outer margin and apex yellowish, tornal angle very obtuse and rounded. Hw pale reddish brown with faint darker wavy submarginal band near tornus.

♀: somewhat larger, darker and with more rounded wings.
♀ GENITALIA: 8th tergite evenly rounded posteriorly, with a very deep anterior sinus. Post-vaginal plate arc-shaped with a shallow median posterior emargination and a rounded lateral lobe on either side. Colliculum absent. Ductus long and slender. Bursa pear-shaped with a small irregular spinose signum halfway to apex.

HABITAT AND RANGE
Lowland forest from West Africa to the Congo and Angola.

Ssp. *tanganyikae* Clark 1938. *Proc. New Engl. zool. Cl.* **17:** 41.
Supposed to be shorter winged and duller than typical specimens. Based on a single male "taken in Tanganyika" ex O. Staudinger and A. Bang-Haas.
NOTE: This species will probably be found in the Bwamba valley of western Uganda.

LOPHOSTETHUS Butler 1877

Trans. zool. Soc. Lond. **9:** 585; type species *Sphinx demolini* Angas 1849.
Very large moths. Proboscis short and weak. Palpus small and slender, third segment acutely pointed. Antennae slender in both sexes. Hindtibia spinose, foretibia armed terminally with a stout spine. Two pairs of long spurs on hindtibia. Pulvilli absent, paronychia single-lobed each side. Larvae armed with branched spines. Two species.

LOPHOSTETHUS DEMOLINI (Angas) 1849. (III; 1)
Sphinx demolini Angas *Kaffr. Illustr.* Pl.30, fig. 11 (Natal).

♂: fw 55–70 mm. Antennae whitish. Ground colour of wings and body light brown. Frons darker, dorsum of thorax dark chocolate. Two dark chocolate dorsal spots on last thoracic setment. Apex

of fw rather blunt, outer margin strongly crenulated; light brown with wavy paler transverse lines. Discal area, between antemedial and postmedial chocolate except near inner margin. Stigma a large arrow-shaped gleaming creamy white spot. A small round spot of the same colour, just inside arrow head. A chocolate triangle near apex and two chocolate wedges in areas 4 and 5, sometimes further wedges in 2 and 3. Hw uniformly light brown, with faint wavy transverse lines.

♀: identical, but slightly larger (fw, 70–75 mm.).

HABITAT AND RANGE

Most habitats, except desert and high mountains throughout the Ethiopian Region, excluding Madagascar and the Cape.

EAST AFRICAN RECORDS

UGANDA	NM :	Tororo, Bwamba, Fort Portal.
	BM :	Madi Opei.
	RJ :	Bulamwezi.
	L :	Mweya.
KENYA	NM :	Mackinnon Road, Mtito Andei, Nairobi, Isiolo, Voi, Sigor (Suk), Thika, Makueni.
	S :	Kitale, Kakamega.
	BM :	Kibwezi, Kionga, Taru, Makindu,
TANZANIA	NM :	Kilosa, Buhemba, Lake Manyara, Ukerewe.
	R :	Dar es Salaam, Ilonga, Mbeya, Mlingano, Ukiriguru.
	BM :	Arusha, Mamboia, Uluguru.
	MC :	Lindi, Songea.
ETHIOPIA	NM :	Gojeb, Wongi (Nazareth).

NOTE: West African specimens (ssp. *carteri* Rothschild 1894, *Novit. zool.* **1**: 97, Lagos) are darker and are linked with the paler eastern and southern form by a continuous cline, Congolese and Uganda specimens being intermediate (ssp. *congoicus* Clark 1937, *Proc. New Engl. zool. Cl.* **16**: 31, Katanga).

LOPHOSTETHUS NEGUS (Jordan) 1926. (III; 2—XII; 2)

Lophostethus demolini negus Jordan *Novit. zool.* **33**: 380 (Kambatta, south-west Ethiopia, ♂).
1964 *Lophostethus negus* Carcasson *J.E. Afr. nat. Hist. Soc.* **24**: (109): 73.

♂: similar to *L. demolini*, but smaller, margin of fw much less crenulated, ground colour much darker, more purplish. Stigmata smaller, more golden. Much less heavily marked below.
GENITALIA: very similar to *L. demolini*, but smaller, not so heavily sclerotised, aedeagus straight, not curved.

FEMALE AND EARLY STAGES: unknown.

HABITAT AND RANGE

Highland forest in Ethiopia.

RECORDS

ETHIOPIA	NM :	Gara Mullata (Harar).
	BM :	Kambatta (Type).

LIKOMA R. & J. 1903

Novit. zool. **9** *suppl.* : 265; type species *L. apicalis* R. & J. 1903.
Proboscis very short and weak, Tibial spurs very short, not spinose. Paronychia vestigial. Modified scales present on 8th tergite and on valve. Larvae granulose, with triangular head. Venation as in *Polyptychus*.

LIKOMA APICALIS R. & J. 1903. (II; 21)
Novit. zool. **9** *suppl.* : 265 (Likoma, Lake Nyasa, ♂).

♂: fw. long and narrow, apex acute, outer margin irregularly crenulated, 26–30 mm. Ground colour pinkish brown to olive brown. Transverse lines of fw fairly straight. Outer marginal area of fw, tornus of hw and first abdominal tergite chocolate. A chocholate spot at inner margin near tornus.

♀: larger (34 mm from base to apex), otherwise similar to ♂.
GENITALIA: 8th tergite broad, with a very deep mesial sinus at posterior margin and a smaller one at anterior margin. Vaginal plate narrower with posterior margin somewhat crenulated. Ostium very wide. Ductus short and wide, heavily sclerotised, constricted near middle. Bursa small, rounded. Struts very long.

RANGE AND HABITAT
Savanna and open woodland from Rhodesia to Tanzania and the Kenya coast.
EAST AFRICAN RECORDS

KENYA	S	:	Mombasa.
TANZANIA	NM	:	Ilonga, Mufindi, Tabora.
	R	:	Mlingano, Dar es Salaam,
	MC	:	Njombe.
	BM	:	Pigawasi, Kondoa, Kasikase.

LIKOMA CRENATA R. & J. 1907. (II; 22)
Novit. zool. **14:** 93, (Mgana, British East Africa, ♂).

♂: very similar to preceding species, but greyer, apex not so acute, margin more regularly crenulated. Transverse bands much more wavy, dark areas reduced, contrasting less with ground colour.

♀: similar to ♂, but darker.
GENITALIA: 8th tergite consisting of 2 lateral lobes joined by a narrow sept. Vaginal plate a regular broad transverse belt. Ductus short and wide, without constriction. Bursa small and rounded. Struts long and slender.
EARLY STAGES: unknown.

RANGE
Coast of East Africa.
RECORDS

KENYA	NM	:	Mombasa, Kilifi.
	BM	:	Simba, Arabuko, Mgana.
TANZANIA	NM	:	Mlingano, Ilonga.
	R	:	Dar es Salaam.
SOMALIA	BM	:	Juba River.
	BE	:	Belet Amin.

POLIODES R. & J. 1903

Novit. zool. **9** *suppl.* : 285; type species *P. roseicornis* R. & J. 1903.
Proboscis very short and weak. Palpi very small. Antennae fasciculate, slender, similar in both sexes. Tibiae spinose; only one pair of short spurs on hindtibia. Pulvillus reduced. Male genitalia without modified scales. Wings very long and narrow, with crenulated margins. Venation as in *Polyptychus*.

POLIODES ROSEICORNIS R. & J. 1903. (II; 23)
Novit. zool. **9** *suppl.* : 285 (Ikutha, British East Africa, ♂).
1915 *Temnora erato* Fawcett *Proc. zool. Soc. Lond.* Pt. **1**: 109 (Masongaleni and Kedai, British East Africa).

♂: fw. 20–22m. Antennae bright pink. Body grey; fw with crenulated transverse lines. Terminal area darker, with some pale grey mottling. A large irregular darker grey spot at costa, beyond middle. Hw. uniform brownish grey, darker at tornus. A faint dark submarginal line.

♀: larger and brighter (fw, 28–30 mm. from base to apex).
GENITALIA: 8th tergite well sclerotised, with slight posterior emargination. Vaginal plate broad, posterior margin sinuous. Ostium wide, ductus very short and wide. Bursa fairly large, spherical. Struts stout, but long.

HABITAT AND RANGE
Dry bush in eastern Kenya and probably in southern Somalia.
EAST AFRICAN RECORDS

KENYA	NM :	Diani, Voi, Mtito Andei, Melka Murri, (Mandera).
	BM :	Mombasa, Kedai, Masongaleni, Makindu, Kibwezi, Ikutha.

CERIDIA R. & J. 1903

Novit. zool. **9** *suppl.* : 286; Type species *Ceridia mira* R. & J. 1903.
Proboscis rudimentary. Abdominal tergites spinose all over. Tibiae spinose; hindtibia with a single pair of unequal spurs; foretibia with a strong terminal spine and a short tooth. Pulvilli and paronychia present, the latter without ventral lobes. Wing margins regular; discoidal cells of both wings sharply indented at origin of vein 5; vein 6 of fw arises just beyond end of cell; veins 6 and 7 of hw on a short stalk. Modified scales absent.

CERIDIA HEUGLINI (Felder) 1874. (III; 3)
Smerinthus heuglini Felder *Reis. Nov. Heteroc.* P1. 78 (Abyssinia, ♂).

Sexes alike, fw with acute apex, 30 mm. Antennae very slender, not pectinated. Ground colour of fw and body pale pinkish brown. A chocolate narrow median stripe on head and thorax. Fw with a conspicuous chocolate marking which touches costa at $\frac{1}{4}$ from base and at $\frac{2}{3}$ from base, leaving intervening areas pinkish brown. A large rounded chocolate stigma touching lower part of chocolate marking. A rounded chocolate marking edged proximally with pale pink at apex. Several faint, sinuous dark transverse lines. Hw paler and pinker, unmarked.

♀ GENITALIA: vaginal plate consisting of a sub-triangular plate on either side of ostium. Colliculum very short, wider at ostium. Ductus rather short, wide, pleated. Bursa small, rounded, unarmed.

HABITAT AND RANGE
Savanna and grassland from W. Africa to Uganda, the Sudan and Ethiopia.
EAST AFRICAN RECORDS

UGANDA	NM :	Bwamba.
	B :	Masindi, Nyabyeya.
	BM :	Gulu.
SUDAN	BM :	Bahr el Ghazal.

CERIDIA MIRA R. & J. 1903. (III; 4)
Novit. zool. **9** *suppl.* : 287 (Ikutha, British East Africa, ♂).

♂: very similar to *C. heuglini*, but antennae strongly pectinated, forewings shorter and broader, ground colour more brownish, not so pink. Fw. 19–21 mm. from base to apex.

♀: similar to ♂, but larger, antennae not pectinated. Fw. 22–24 mm from base to apex.

HABITAT AND RANGE
Dry bush in eastern and northern Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kinna, Isiolo, Mtito Andei, Voi.
	BM :	Ikutha (Type), Kibwezi, Taveta, Kedai, Masongaleni.

CERIDIA NIGRICANS Griveaud 1959.
Faune Madag. **8**: 71 (Madagascar).
Madagascar only.

CERIDIA STUCKENBERGI Griveaud 1959.
Faune Madag. **8**: 72 (Madagascar).
Madagascar only.

XENOSPHINGIA Jordan 1920

Novit. zool. **27**: 169; Type species *Xenosphingia jansei* Jordan 1920.

XENOSPHINGIA JANSEI Jordan 1920.
Novit. zool. **27**: 169 (Southern Rhodesia, ♂).
Arid bush in western Rhodesia and adjoining Botswana.

PSEUDOPOLYPTYCHUS gen. nov.

Proboscis very short. Tibial spurs very short, unarmed, appressed to tibia. Retinaculum absent, frenulum very weak. Similar in appearance to *Afroclanis*. Uncus bilobed, gnathos crecent-shaped. Harpe small, basal. Aedeagus and vesica unarmed.
TYPE SPECIES: *Polyptychus foliaceus* R. & J. 1903.

PSEUDOPOLYPTYCHUS FOLIACEUS (R. & J.) 1903. (XI; 13)
Polyptychus foliaceus R. & J. *Novit. zool.* **9** *suppl.* : 257 (Misa Hill, Togo, ♀).
Ghana to Nigeria.

AFROCLANIS gen. nov.

Proboscis well developed. Palpi short. Antennae slender in both sexes. Abdominal tergites with spines confined to posterior margins. Tibiae spinose; two pairs of long stout spineless hindtibial spurs. Venation as in *Polyptychus;* wing margins entire, colour of hw red; facies recalls species of *Lybioclanis* R. & J. Apex of aedeagus armed, valve entire, harpe present; uncus bilobed.
TYPE SPECIES: *Polyptychus calcareus* R. & J. 1907.

AFROCLANIS CALCAREA (R. & J.) 1907 comb. nov. (III; 6—XIII; 3)
Polyptychus calcareus R. & J. *Novit. zool.* **14:** 92 (Masasi, German East Africa, ♂).
Polyptychus aurora Clark 1936 *Proc. New Engl. zool. Cl.* **15:** 77 (Kafakumba, Katanga) is probably an aberrant ♀ of above (not seen).

♂: fw 29–32 mm; apex acute, but not falcate; reddish brown to brownish purple, with a large dark spot at costa before apex and a small dark stigma; hw brick red, usually darker at margin.
GENITALIA: uncus very short and broad, terminating in two blunt, well sclerotised lateral spines. Gnathos consisting of an undivided median lip; saccus short and rounded. Valve oval; harpe a longitudinal toothed ridge terminating in a rounded posterior lobe surmounted by bristles; a central membranous area above ridge. Aedeagus short and stout, terminating in a funnel armed with numerous sharp teeth and a rounded structure with smaller teeth.

♀: larger, otherwise similar; fw 34–36 mm.
GENITALIA: 8th sternite a narrow, ill-defined sclerotised transverse band posterior to ostium. Ductus short, broad, well sclerotised; bursa pear-shaped, membranous, sclerotised and fluted at base.

HABITAT AND RANGE
Brachystegia woodland from Rhodesia and Mozambique to Malawi, Zambia, Katanga and Tanzania.
EAST AFRICAN RECORDS
TANZANIA BM : Masasi (Type).
R : Ilonga.
MC : Lindi, Songea.

AFROCLANIS NEAVI (Hampson) 1910 comb. nov.
Polyptychus neavi Hampson *Proc. zool. Soc. Lond.* : 492 (Luangwa Valley, N. Rhodesia, ♂).
1911 *Polyptychus martha* Closs *Int. ent. Z. Guben* **5:** 50 (♂).

Ssp. *neavi.* (III; 5—XI; 16)
♂: fw. 24–28 mm., pointed but not falcate. Fw brownish purple with a dark triangle at apex and a dark band from tornus to end of cell. Hw. red with a diffuse dark area at margin near tornus. Body bright brownish purple with darker tegulae. Antennae pink, tibiae and tarsi silvery white.
GENITALIA: uncus as in *A. calcarea*, but terminal lateral spines longer and sharper, with a number of smaller spines at distal margin between the two major spines. Gnathos and saccus as in *calcarea.* Valve as in *calcarea*, but harpe more spinose; a dense cushion of bristles near centre of inner surface of valve. Aedeagus as in *calcarea*, terminating in a spinose funnel, but rounded spiny structure missing.

♀: similar, but slightly larger (Fw., 28–30 mm.).
GENITALIA: almost identical with *A. calcarea;* 8th sternite broader and more regular; ductus longer and narrower; base of bursa not sclerotised.

HABITAT AND RANGE
Savanna and woodland from Rhodesia to Tanzania.
EAST AFRICAN RECORDS
TANZANIA NM : Ilonga, Ukiriguru, Amani.
BM : Kilosa.

Ssp. *burorum* (Strand) 1915.
Polyptychus neavi burorum Strand *Arch. Naturgesch.* **81:** 131 (Transvaal, South Africa, ♀).
South Africa only.

LIBYOCLANIS R. & J. 1906

Novit. zool. **13:** 180; type species *Clanis bicolor* Rothschild 1984.
1906 *Typhosia* R. & J. *Novit. zool.* **13:** 406; type species *Typhosia illustris* R. & J. 1906, syn. nov.

Proboscis short, not reaching beyond hind coxa. Antennae slender in both sexes. Palpi short, not protruding beyond frons. Eyes ciliated. Abdominal tergites with scattered, weak spines. Tibiae spinose, a single pair of short tibial spurs. Pulvillus present, paronuchium bilobed. Wings narrow and long, apex sometimes hooked, specially in ♀. Frenulum present. Apex of discoidal cell truncated in both wings, veins 6 and 7 of hw on a long stalk. ♂ genitalia without modified scales. Larva cylindrical, granulose, with triangular head in early instars, round in later instars.

LIBYOCLANIS BICOLOR (Rothschild) 1894.
Clanis bicolor Rothschild *Novit. zool.* **1:** 96 (? *patria*, ♀).
1914 *Phylloxiphia formosa* Schultze *Arch. Naturgesch.* **80** A H2: 125 (Cameroons, ♀).
1915 *Libyoclanis major* R. & J. *Novit. zool.* **22:** 284 (West Africa, ♂).
Forests from Sierra Leone to the Congo and Angola.

LIBYOCLANIS OWENI sp. nov. (X; 5—XII; 5)

Very closely allied to *L. vicina* R. & J., but differs in its greater size, and in having a more acuminate apex and more concave outer margin to the fw.

♂: antennae, buff-pink above; head, upperside of thorax and basal tergites of abdomen snuff-brown; remainder of abdomen and underside of thorax light pinkish cinnamon. Legs snuff-brown.

UPPERSIDE
FOREWING: base to apex 48 mm. (36 mm in *L. vicina*). Apex very acute, outer margin concave below apex, slightly convex before tornus; costa strongly curved near apex. Groundcolour shiny wood brown. Darker transverse bands as in *L. vicina* and *L. bicolor* Rothschild, but extremely faint. Apical dark spot absent, oblique streak from apex extremely faint. A dark hair pencil at base of inner margin.
HINDWING: Apex acute, outer margin straight, tornus slightly produced. Groundcolour dragon's blood red; costal area cartridge buff from base to $\frac{1}{3}$ from apex; outer margin with very narrow purplish brown border becoming wider before tornus, where it shades to buff-pink; tornus buff-pink, inner margin cartridge buff; cilia cartridge buff.

UNDERSIDE
FOREWING: basal half dragon's blood red except at inner margin which is cartridge buff. Apical half shading through light pinkish cinnamon to wood brown. An evenly curved oblique dark line from apex to vein 4, presumably continued by the terminal line of the hindwing when the insect is at rest, as in other species of the genus. Termen and cilia brown.
HINDWING: light pinkish cinnamon with a broad red streak parallel to inner margin. Two faint parallel dark lines from costa at $\frac{1}{2}$ and $\frac{3}{4}$ from base to vein 4. Termen narrowly dark brown. Cilia cartridge buff.

GENITALIA: uncus very deeply bilobed, the two lobes apically rounded and sclerotised. Gnathos a subquadrate plate slightly incurved mesially, with an internal elongated sclerotised longitudinal process with truncated apices protruding well beyond lip of gnathos. A semicircular plate armed with tubercles at the margin, at the base of upper margin of each valve. Saccus short and slender. Valve very long and slender, apically pointed. Harpe terminating in a sharp up-curved spine just inside middle of ventral margin of valve. Aedeagus unarmed, slender, curved; basal lobe long and slender.
♀ AND EARLY STAGES: unknown.

HOLOTYPE ♂: Sierra Leone, Freetown, VI-1967, D. F. Owen, K. 20, to be deposited in the British Museum, Natural History.
This species is dedicated to its discoverer, Professor D. F. Owen of the University of Sierra Leone.

LYBIOCLANIS KARSCHI (R. & J.) 1903.
Pseudoclanis karschi R. & J. *Novit. zool.* 9 *suppl.* (Victoria, Cameroons, ♀).

Ssp. *karschi.*
Cameroons to the Congo.
A specimen glimpsed for a moment by the writer on the flap of his tent at Bwamba, in western Uganda, almost certainly belonged to this species.

Ssp. *bainbridgei* R. & J. 1906.
Novit. zool. **13:** 180 (Sierra Leone).
The West African race.

LIBYOCLANIS VICINA R. & J. 1915.
Novit. zool. **22:** 285 (Nigeria, ♂).
Known from Liberia, Nigeria to the Congo.

LIBYOCLANIS PUNCTUM Rothschild 1907. (III; 7)
Novit. zool. **14:** 507 (Salibsury, Rhodesia, ♂).

♂: head and thorax bright pinkish brown, abdomen paler. Fw. 35 mm., long and narrow, pinkish brown with a blackish dot near apex and a reddish inner marginal basal streak. Hw pinkish orange; apex acute, tornus somewhat produced, outer margin almost straight.

♀: not seen, but said to be larger and to have more rounded wings.

HABITAT AND RANGE
Savanna from the Transvaal to Rhodesia, Zambia, Katanga and Tanzania.
One ♂ taken by Dr. C. McCleery at Songea, S. Tanzania, April 1962.

LIBYOCLANIS METRIA Jordan 1920. (III; 8)
Novit. zool. **27:** 167 (Rhodesia, ♂).
♂: head and thorax light brown, much darker than abdomen. Fw. 37 mm., pale pinkish brown, mottled and marked with darker brown. Hw pinkish red. Size and shape much as in two preceding species.

♀: similar to ♂, but larger, wings broader and more rounded. Fw, 45 mm.
HABITAT AND RANGE
Brachystegia woodland in Rhodesia, Katanga, Zambia and Tanzania.
EAST AFRICAN RECORDS

TANZANIA	NM :	Ilonga.
ZAMBIA	NM :	Abercorn.

LIBYOCLANIS NOCTIVAGA Kernbach 1957.
Rev. Zool. Bot. afr. **55:** 176.
Described from a pair from Elisabethville, Katanga. Almost certainly a synonym of *Libyoclanis metria* Jordan.

LIBYOCLANIS ILLUSTRIS (R. & J.) 1906 comb. nov. (III; 9)
Typhosia illustris R. & J. *Novit. zool.* **13:** 406 (Gold Coast, ♂).

♂: differs from other species of the genus in having 2 strong emarginations at the termen of the fw. Fw, 27–29 mm., from base to apex. Apex very acute; margin concave from apex to end of vein 2 and again from vein 2 to tornus which is somewhat produced. Fw and body straw-coloured. Fw with a number of irregular, dark transverse lines. Fringe dark brown. Hw strongly produced at tornus, pinkish red; tornal area straw-coloured.
GENITALIA: uncus deeply bilobed; gnathos a narrow belt. Saccus very slender. Valve very long and slender, membranous. Harpe a lightly sclerotised simple plate projecting inwards above middle of ventral margin. Inward projecting process at dorso-basal margin of valve longer and narrower than in other species of the genus. Aedeagus long and slender, unarmed; basal lobe long and slender.
FEMALE AND EARLY STAGES: unknown.

HABITAT AND RANGE
Lowland forest from Liberia to the Congo and western Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Bwamba.

LIBYOCLANIS GOODI (Holland) 1889 comb. nov. (X; 8)
Polyptychus goodi Holland *Trans. Amer. ent. Soc.* **16:** 64 (Upper Ogowe River, ♀).

One ♀ in B.M. from Irumu, eastern Ituri district, Congo. A figure of the undescribed ♂ is appended, but the insect cannot be described as it is in a private collection (Coll. P. N. Darge, Paris) and therefore inaccessible. The specimen was taken at Franceville, Gabon and the photo was supplied by Dr. P. C. Rougeot of the Muséum National, Paris.

PHYLLOXIPHIA R. & J. 1903

Novit. zool. **9** *suppl.* : 263; type species *P. oberthueri* R. & J. 1903.

PHYLLOXIPHIA OBERTHUERI R. & J. 1903.
Novit. zool. **9** *suppl.* :263 (Lolodorf, Cameroons, ♂).
1916 *Libyoclanis hollandi* Clark *Proc. New Engl. zool. Cl.* **6:** 62 (Cameroons, ♀).
Lowland forest from West Africa to the Congo.

NEOCLANIS gen. nov.

Proboscis short and weak. Frons not crested. Palpi small. Eyes ciliated. Tibiae spinose, two pairs of hindtibial spurs. Pulvillus present, paronychium absent. Wing margins entire and regular, frenulum present. Apex of discoidal cell of fw produced distad anteriorly, indented at origin of vein 5; cell of hw broad and prolonged distally at vein 4; veins 6 and 7 with common origin, but not stalked. Male genitalia without modified scales. Differs mainly from *Leucophlebia* Westwood and from *Leptoclanis* R. & J. in the deeply divided uncus, in the absence of projections at the base of the valve and in the strongly bent aedeagus, and from *Leptoclanis* in the absence of signa in the ♀.
TYPE SPECIES: *Smerinthus basalis* Walker 1866.

NEOCLANIS BASALIS (Walker) 1866. (III; 10—XII; 1—XIII; 5)
Smerinthus basalis Walker *List. Lep. Ins. B.M.* **35:** 1858 (Zambesi River).
1881 *Choerocampa virgo* Westwood in Oates, *Matabeleland:* 354 (Zambesi).
1903 *Leptoclanis basalis* R. & J. *Novit. zool.* **9** *suppl.* : 229.

♂: fw 30–40 mm., very pale greyish green, densely speckled with darker spots. Hw similar, more heavily speckled and with a large red patch at base.
GENITALIA: uncus very deeply divided, consisting of two slender, well sclerotised downcurved processes separated by a broad sinus which almost reaches base of uncus. Gnathos slender and pointed, as long as uncus lobes. Saccus slender. Valve entire, rounded; harpe basal, long and broad, terminating in a rounded upright lobe armed with small spines. Aedeagus short and stout, sharply bent downwards; vesica unarmed.

♀: similar but larger (fw up to 50 mm.), broader winged, more heavily speckled.
GENITALIA: vaginal plate divided into 2 rounded lobes. Ductus long and membranous, as wide as bursa. Signa absent.

HABITAT AND RANGE
Dry bush and woodland from Rhodesia and Angola to Zambia, Tanzania and east Kenya.
EAST AFRICAN RECORDS

KENYA	NM	:	Mtito Andei, Kilifi.
TANZANIA	NM	:	Lake Rukwa, Ilonga.
	SM	:	Saza.
	BM	:	Musoma, Shinyanga, Kilosa.
	R	:	Mlingano.
	MC	:	Lindi, Songea.

LEUCOPHLEBIA Westwood 1848

Cab. Or. Ent. : 46; type species *Leucophlebia lineata* Westwood 1848 (India).
1875 *Rasphele* Boisduval; type species *Rasphele lineata* (Westwood) 1848 (India).

Four species, two Oriental and two African. Probosics very short and weak. Frons with prominent crest. Antennae thick, strongly compressed and grooved in ♂, much more slender in ♀. Palpi much smaller in ♀ than in ♂. Abdominal tergites spinose, particularly at distal edge. Tibiae spinose, hindtibiae armed with two pairs of spurs. Pulvillus present. Paronychium with lobes short and slender, particularly the lateral ones. Wing margins entire, frenulum present. Veins 6 and 7 of hw not stalked. Valve without modified scales, aedeagus and vesica unarmed. Bursa of ♀ without signa. (*L. afra* Karsch).
LARVA: body granulose, horn short, head triangular (*L. lineata* Westwood). The Indian species *L. lineata* is known to feed on *Saccharum* and it is very probable that the two African species also feed on *Graminaceae*. Small pink and yellow moths.

LEOCOPHLEBIA NEUMANNI Rothschild 1902. (III; 12)
Novit. zool. **9.** : 598 (Akobo River, Ethiopia, ♀).

Only the ♀ is known. Head and body entirely rosy red. Fw pink with yellow longitudinal streak. Hw orange yellow. Mid and hindtibiae creamy white.
GENITALIA: 8th sternite broadly sclerotised, with a narrow median posterior sinus, and a deep anterior cleft with reflexed edges. Post-vaginal plage broad with a median sinus dividing posterior margin into 2 shallow rounded lobes. Ostium leading into a shallow sclerotised cup from the base of which the very long and slender ductus originates. Colliculum absent. Bursa small, being scarcely wider than ductus, unarmed.

RANGE AND HABITAT
Dry bush in southern and western Ethiopia and in northern Uganda.
EAST AFRICAN RECORDS

UGANDA	SM :	Karamoja.
ETHIOPIA	BM :	Akobo River, Blue Nile.

NOTE: *L. neumanni* may well be the African subspecies of the Indian *L. emittens* Walker, 1866 (*List. Lep. Ins. B.M.* : 1858), but the matter cannot be decided until the ♂ is known.

LEUCOPHLEBIA AFRA Karsch 1891.
Ent. Nachr. **17:** 12 (Mukenge, Kasai, ♂).

♂: fw. 20–25 mm. Palpi and frons red. Thorax pink, abdominal tergites black edged distally with orange. Venter rosy red; legs, including tibiae red. Fw. various shades of pink with a creamy yellow median streak from base to apex and a creamy stigma. Hw yellow to orange.

♀: larger and darker than ♂, fw up to 30 mm.
GENITALIA: vaginal plate deeply divided into 2 sub-lateral lobes connected with the corresponding tergite at the base of the first pair of struts. Ductus bursae very slender, not sclerotised. Bursa long, slender, with a small subapical, lateral lobe. Signum and operculum absent.
Four subsepcies have been described, based on differences in colour, pattern and genitalia, the latter being trivial and unstable. The range of the species is continuous, covering grassland areas throughout Africa, excluding South Africa and N.E. Africa and the four subspecies intergrade and overlap; only two are recognised here, and it is very likely that even these two are not real races, but seasonal and climatic forms.

Ssp. *afra* Karsch 1891.
1917 *Leucophlebia afra edentata* R. & J. *Novit. zool.* **23:** 254 (Gold Coast)

Dorsum of thorax and head very pale pink, contrasting strongly with red of frons and palpi. Fw very pale pink, lower edge of creamy longitudinal streak entire.
GENERAL DISTRIBUTION
Senegal to N. Uganda and the Sudan in the east, and to Angola in the west. Overlaps with the following race in Uganda and in the southern Congo.
EAST AFRICAN RECORDS

UGANDA	NM :	Aremo (Karamoja) Madi Opei; Gulu; Lake Kyoga; Kidepo, Chobe.
SUDAN	BM :	Bahr el Ghazal, Lado, Lokoja.
TANZANIA	NM :	Buhemba (Musoma).

Ssp. *xanthopis* Hampson 1910. (III; 11)
Proc. zool. Soc. Lond: 461 (South-East Katanga).
1917 *Leucophlebia afra rosulenta* R. & J. *Novit. zool.* **23:** 256 (Mahoro, German East Africa).

Differs from *afra* in having all the pink areas of the wings and body above much brighter and darker, providing little constrast between the palpi and frons and the rest of the head and thorax. In the more extreme form (*xanthopis*) the lower margin of the creamy fw band is indented between the veins; in form *rosulenta* it is entire.

RANGE: Rhodesia, Zambia, Katanga, Malawi, Mozambique, Tanzania, S. Uganda and west Kenya.
EAST AFRICAN RECORDS (form *rosulenta*).

KENYA	S :	Istsare, Kitale.

UGANDA	NM	:	Nsongesi, Mubende.
	BM	:	Mbale, Ankole, Ketoma.
TANZANIA	NM	:	Ilonga, Mikumi.
	R	:	Mbeya.
	BM	:	Tunduma, Mpwapwa, Tendaguru.
Form *xanthopis.*			
ZAMBIA	NM	:	Abercorn.

LEPTOCLANIS R. & J. 1903

Novit. zool. **9** *suppl.* : 228; Type species *Leptoclanis pulchra* R. & J. 1903.

Proboscis short and weak. Palpi short and slender. Antennae slender. Head crested. A small tuft of hairs in front of eye, a larger one behind. Abdominal tergites smooth, spines confined to distal edges. Tibiae spinose; spines few, but prominent, those at end of foretibia longer. Tibial spurs short, hind tibia with two pairs. Pulvillus present, paronychium absent. Male genitalia without modified scales, very similar to *Leucophlebia;* female genitalia with signum. Margin of wings entire and regular, frenulum present. Veins 6 and 7 of hw arise independently. One species only.

LEPTOCLANIS PULCHRA R. & J. 1903. (III; 15—XII; 4,8)
Novit. zool. **9** *suppl.* : 228 (Salisbury, Rhodesia, ♂).

♂: fw. 30–35 mm., creamy green with dark green markings, rather as in *Batocnema africana* Distant. Hw. rosy red, bordered with green.

♀: darker than ♂, wings broader and more rounded; fw 40 mm.
GENITALIA: 8th tergite broadly sclerotised, with a very deep median sinus; posterior margin of 8th sternite not so broadly sclerotised. Ductus long, membranous, with numerous small tubercles near ostium. Bursa pear-shaped with a large pear-shaped spinose signum near base. Struts long and fairly stout; posterior pair dilated before apex.

HABITAT AND RANGE
Brachystegia woodland from Angola and Rhodesia to Zambia, Katanga and southern Tanzania.
EAST AFRICAN RECORDS

ZAMBIA	NM	:	Abercorn.
TANZANIA	R	:	Mbeya, Mbimba.
	BM	:	Songea.
	MC	:	Lindi.

PLATYSPHINX R. & J. 1903

Novit. zool. **9** *suppl.* : 224; type species: *Ambulyx constrigilis* Walker 1869.

Proboscis short and stout. Palpi not protruding beyond frons. Antennae fasciculate, much thicker in ♂. A tuft of long hairs behind eye. Abdominal tergites spinose. Tibiae spinose, only one pair of short hindtibial spurs. Pulvillus and paronychium present. Wing margins regular, frenulum present. Veins 6 and 7 of hw with common origin, but not stalked. ♂ genitalia without modified scales, with very broad uncus and with cornuti. All large, yellowish species with a prominent black patch at base of hw., which is speckled with red.
Larvae with granular skin and triangular head.

PLATYSPHINX LEMOULTI Clark 1936 *Prov. New Engl. zool. Cl.* **15:** 76 (Belgian Congo) Not seen.

PLATYSPHINX CONSTRIGILIS (Walker) 1868.
Ambulyx constrigilis Walker *Proc. nat. Hist. Soc. Glasgow* **1:** 328 (Congo, ♂).

Ssp. *constrigilis.* (III; 13)
♂: fw. more falcate than in following species, 55–60 mm. Ground colour very pale greenish brown with darker markings. A narrow, well defined dark streak from costa to centre of outer margin. Hw. yellow with large black patch at base and 2 irregular parallel red bands and numerous small red spots. Underside more greenish, less irrorated with dark scales, showing usual Sphingid pattern of parallel crenulate postdiscal and submarginal bands much more clearly than other species.

♀: larger, darker, broader winged.
GENITALIA: ovipositor lobes large. Struts long and slender. Sclerotised portion of 8th tergite broad and regular. Ostium flanked by a pair of pointed lateral processes directed posterad. Ventro-posterior margin of ostium produced into two small rounded lobes. Ductus entirely membranous, long, spirally coiled, with a large rounded bulge near the middle. Bursa very small, rounded, without signa.

HABITAT AND RANGE
Forests from the Cameroons to Angola, the Congo, Uganda and west Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Mabira, Katera, Bwamba.

Ssp. *vicaria* Jordan 1920.
Novit. zool. **27:** 164 (Sierra Leone).
Differs from the nominate race in minor details of the genital armature. Sierra Leone to Nigeria.

The three following species have been treated as subspecies by several authors and can only be separated from one another after dissection of the genitalia. However, as the genitalia are very different indeed and as there is some overlap, at least in the case of *P. phyllis* R. & J. and *P. stigmatica* Mabille in Nigeria, and between *P. stigmatica* and *P. piabilis* Distant in Zambia and in Katanga, it is probably best to treat them as distinct species. A brief description of the imago will suffice for all three:

MALES: fw. 58–62 mm., less falcate than in *P. constrigilis*, not so greenish. Longitudinal streak and other dark markings much less distinct. Red spots in hw evenly distributed, not arranged in regular bands. Pattern of underside much less distinct, dark irrorations more conspicuous.

FEMALES: fw. 60–65 mm., broader, less acuminate, darker and more reddish than in males; hw more heavily spotted with red.

PLATYSPHINX PHYLLIS R. & J. 1903.
Novit. zool. **9** *suppl.* : 226 (Konakry, Guinea, ♀).
Sierra Leone to Nigeria.

PLATYSPHINX STIGMATICA (Mabille) 1878. (III; 14)
Basiana stigmatica Mabille *Bull. Soc. zool. France* **2:** 491 (Congo).
1879 *Basiana conspersa* Dewitz *Mitt. munch. ent. Ver.* **3:** 29 (Chinchoxo, Angola).

♂ GENITALIA: uncus short, terminating in 2 well sclerotised rounded lobes. Medial process of gnathos much broader at base, tapering gently. Valve trilobed, the upper lobe strongly sclerotised, very long, narrow and pointed. The mesial lobe rounded and membranous. The ventral lobe long, very strong, sharp and in the form of a hook directed upwards and outwards. Saccus very broad, short, blunt and membranous. Aedeagus longer and more slender than in *constrigilis*, armed on ventral surface with a long terminal hook. Vesica armed with a comb of small dense spines.

♀ GENITALIA: operculum prominent, supported distally by a strong, broad bilobed vaginal plate. Ductus long, sclerotised, constricted at ostium and before bursa. Bursa small, spherical, with central, minutely spinose U-shaped signum.

HABITAT AND RANGE

Forest up to 5,000 ft. from Nigeria to the Congo, Angola and western Uganda.

EAST AFRICAN RECORDS

UGANDA	NM :	Bwamba, Fort Portal.
	K :	Budongo.

PLATYSPHINX PIABILIS (Distant) 1897.

Ambulyx piabilis Distant *Ann. Mag. nat. Hist.* (6) **19:** 580 (Transvaal).

♂ GENITALIA: uncus short, broad, terminating in two blunt, heavily sclerotised processes. Mesial process of gnathos intermediate between *P. constrigilis* and *P. stigmatica*. Valve rounded, entire, with a central, longitudinal membranous area; upper half heavily sclerotised, armed marginally and internally with short spines, Lower portion of valve heavily sclerotised, but smooth; a short hook at base of valve, placed ventro-internally, much shorter than in other species. Saccus very short, membranous. Aedeagus bent downward at middle, armed with long terminal spine, Vesica armed with comb of dense spines.

♀ GENITALIA: operculum long and prominent, distal rim formed by two pointed processes of the vaginal plate which are curved inwards. Ductus bursae long, fairly broad and well sclerotised. Signum with irregular, up-raised margins and a narrow anterior cleft, covered in minute rounded tubercles.

HABITAT AND RANGE

Savanna and other open habitats in southern and eastern Africa.

EAST AFRICAN RECORDS

KENYA	NM :	Makueni, Kilifi.
TANZANIA	NM :	Dodoma.
	R :	Ilonga, Mlingano, Ukiriguru, Tabora.
	MC :	Lindi, Songea.
ZAMBIA	NM :	Abercorn.

Tribe ACHERONTIINI

Subtribe ACHERONTIAE

HERSE Oken 1815

Lehrb. Naturg. **3:** 762; type species *Sphinx convovuli* Linnaeus 1758.

Large grey moths. Proboscis very long, tapering distally. Antennae straight and thick, with terminal hook. Foretarsus armed with a few large external spines. Mid and hindtarsi spinose, with comb of

bristles at base. Tibiae not spiny; midtibiae with a single pair of apical spurs, hindtibiae with two pairs. Pulvillus very small, paronychium with a single lobe at each side. Modified scales present on valve. Vein 6 of fw free, 6 and 7 of hw not stalked.

Five species of which one is American, one widely distributed throughout the Old World and 3 Australian and Australasian.

HERSE CONVOLVULI (Linnaeus) 1758.
Sphinx convolvuli Linnaeus *Syst. Nat.* **10:** 490 (Europe).
1798 *Sphinx abadonna* Fabricius *Ent. Syst. Suppl.* : 435.
1865 *Sphinx roseofasciata* Koch *Indo-Austr. Lep. Fauna:* 54.
1870 *Sphinx pseudo-convolvuli* Schaufuss *Nung. Otios:* 15 (Natal).
1877 *Protoparce distans* Butler *Trans. zool. Soc. Lond.* **9:** 609 (New Zealand, Australia).
1877 *Protoparce orientalis* Butler *l.c.* (India, Ceylon etc.)

♂: fw. 40–58 mm., irregularly mottled grey with numerous very irregular narrow transverse lines. Thorax and head grey. Abdomen transversely banded with alternate black and pink stripes interrupted by a continuous grey dorsal stripe. Hw grey with four dark transverse bands.

♀: similar to ♂, but fw less variegated, more uniform grey.

HABITAT AND RANGE
A very strong flier and occasional migrant and consequently extremely widely distributed in practically all habitats in Africa, Madagascar, Seychelles, Europe, Asia and Australia. This species feeds regularly at flowers from dusk onwards.

EAST AFRICAN RECORDS

KENYA	NM :	Nakuru, Nyeri, Limuru, Nairobi, L. Rudolf.
	SM :	Kitale, Istsare, Elgon, Nairobi, Dida.
	S :	Mombasa.
UGANDA	NM :	Masaka.
	S :	Budongo, Entebbe, Bombo.
	B :	Chobe Nyabyeya, Nakawa.
TANZANIA	NM :	Amani, Arusha, Nachingwea.
	R :	Arusha, Dar es Salaam, Ilonga, Mbeya, Tabora, Mlingano, Ukiriguru.
	MC :	Lindi, Songea.

ACHERONTIA Laspeyres 1809

Jenaische Allg. Lit. Zeit. **4:** 99; type species *Sphinx atropos* L. 1758.
1815 *Atropos* Oken *Lehrb. Naturg.* **3:** 762; type *atropos* L. 1758.
1829 *Brachyglossa* Boisduval *Ind. Meth.* : 33.

Large, stout bodied, brown and yellow moths. Proboscis short, but very thick and hairy. Antennae thick and straight, with terminal hook. Tibiae without spines, tarsi spinose. Midtibiae with one pair of spurs, hindtibiae with two. Pulvillus absent, paronychium reduced. Veins 6 and 7 of both wings stalked. For genitalia and early stages, see *A. atropos* L. Three species, 2 of which are Asiatic and 1 African and European.

ACHERONTIA ATROPOS (Linnaeus) 1758.
Sphinx atropos Linnaeus *Syst. Nat.* **10:** 490 (Europe).

The sexes are identical in appearance. Fw. 45–60 mm., from base to apex. Head and thorax blackish; a series of ochreous markings on thorax, resembling a human skull. Abdomen ochreous yellow with black transverse band along the posterior edge of each tergite, and a grey blue dorsal stripe, interrupted by the black bands, from base to apex. Fw brownish black mottled and variegated with brown and black. Hw ochreous yellow with two transverse black bands.

HABITAT AND RANGE

This species is a strong flier and an occasional migrant. It occurs in most habitats except the more extreme ones in most of Europe, the Middle East. Africa, Madagascar and the Seychelles.

EAST AFRICAN RECORDS

KENYA	NM :	Makueni, Nairobi, Isiolo, Nakuru, Nanyuki.
	SM :	Kitale, Istsare.
	S :	Mombasa.
UGANDA	S :	Kampala, Bombo.
	B :	Nyabyeya, Nakawa, Chobe.
TANZANIA	NM :	Amani, Mufindi.
	R :	Arusha, Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea, Nachingwea.

COELONIA R. & J. 1903

Novit. zool. **9** *suppl.* : 24; type species *Protoparce fulvinotata* Butler 1877 (*Sphinx solani* Boisduval 1833)
Proboscis very long, thicker than in *Herse*. Antennae straight and hooked, longer and more slender than in 2 previous genera, particularly in ♀. Tarsi spinose, tibiae without spines. One pair of unequal midtibial spurs, two pairs of hindtibial spurs. Pulvillus present, paronychium with 2 lobes on each side. Vein 6 of fw free, veins 6 and 7 of hw stalked.

COELONIA MAURITII (Butler) 1877. (IV; 1)

Protoparce mauritii Butler *Trans. zool. Soc. Lond* **9**: 106 (? Mauritius).
Hitherto misidentified as *C. fulvinotata* (Butler) 1875. Both types in Brit. Mus. (Nat. Hist), have been examined and *C. fulvinotata*, which carries no data, is merely a synonym of the Madagascar species *C. solani* (Boisduval) 1833.

♂: fw. 52–55 mm. Body and wings brown. Two bright pink dorsal hair tufts at base of abdomen. Fw mottled and variegated with lighter brown and dark indistinct wavy lines. Hw darker, with a black basal patch surrounded by a large ochreous yellow patch. Abdomen with a large rounded yellow spot on each side of first 3–4 abdominal segments.

♀: larger and darker than ♂. Subapical area of fw much paler and more conspicuous. Antennae more slender.

GENITALIA: signum a double spinose ridge, almost as long as bursa.

HABITAT AND RANGE

Most habitats, excluding the more extreme ones, throughout the Ethiopian Region, including Mauritius and Madagascar.

EAST AFRICAN RECORDS

KENYA	NM :	Nairobi, Kitale, Kakamega.
	S :	Mombasa.
UGANDA	NM :	Kampala, Budongo.
	B :	Nakawa, Mpanga, Nyabyeya.
	RJ :	Butiti.
	L :	Mweya.

EXPLANATION OF PLATES

Plate I

1 *Lycosphingia hamata* Dewitz ♂, Kibale forest, Uganda
2 *Acanthosphinx guessfeldti* Dewitz ♂, Bukoba, Tanzania
3 *Polyptychus orthographus* R. & J. ♂, Bwamba, Uganda
4 *Polyptychus trisectus* Aurivillius ♂, Bwamba, Uganda
5 *Polyptychus carteri* form *carteri* Butler ♂, Budongo forest, Uganda
6 *Polyptychus carteri* form *poliades* R. & J. ♂, Bwamba, Uganda
7 *Polyptychus coryndoni* R. & J. ♂, Abercorn, Zambia
8 *Polyptychus baxteri baxteri* R. & J. ♂, Mikumi, Tanzania
9 *Polyptychus nigriplagus* R. & J. ♂, Bwamba, Uganda
10 *Polyptychus pauperculus* Holland ♂, Calabar, Nigeria
11 *Polyptychus affinis* R. & J. ♂, Kakamega, Kenya
12 *Neopolyptychus serrator commodus* Jordan ♂, Kibale forest, Uganda
13 *Neopolyptychus consimilis consimilis* R. & J. type ♂, Ethiopia (BM)
14 *Neopolyptychus prionites* R. & J. ♂, Budongo forest, Uganda
15 *Neopolyptychus convexus* R. & J. ♂, Abercorn, Zambia
16 *Neopolyptychus convexus* R. & J. ♂, N.W. Rhodesia (Topotype, BM)
17 *Neopolyptychus compar compar* R. & J. ♂, Salisbury, Rhodesia (Type, BM)
18 *Neopolyptychus compar compar* R. & J. ♀, Umtali, Rhodesia

Plate II

1 *Polyptychopsis marshalli marshalli* R. & J. ♂, Umtali, Rhodesia
2 *Polyptychoides grayi niloticus* Jordan ♂, Mtito Andei, Kenya
3 *Polyptychoides grayi niloticus* Jordan ♀, Mtito Andei, Kenya
4 *Polyptychoides digitatus* Karsch ♂, Bwamba, Uganda
5 *Polyptychoides erosus* Jordan ♀, Amani, Tanzania (BM)
6 *Pseudoclanis postica postica* Walker ♂, Makueni, Kenya
7 *Pseudoclanis molitrix molitrix* R. & J. ♂, Bwamba, Uganda
8 *Pseudoclanis rhadamistus* Fabricius ♂, Bwamba, Uganda
9 *Microclanis erlangeri* R. & J. ♂ (? wet season form), Watamu, Kenya (BM)
10 *Microclanis erlangeri* R. & J. ♀, Mtito Andei, Kenya
11 *Andriasa contraria contraria* Walker (form *stigmatica* Gehlen), ♂, Nairobi, Kenya
12 *Andriasa contraria contraria* Walker ♀, Thego river, Kenya
13 *Rufoclanis numosae subjecta* Walker ♀, Makueni, Kenya
14 *Falcatula falcata* R. & J. ♂, Kigoma, Tanzania
15 *Falcatula cymatodes* R. & J. ♂, Kibale forest, Uganda
16 *Rufoclanis rosea* Druce ♂, Budongo forest, Uganda
17 *Rufoclanis fulgurans* R. & J. ♂, Ilonga, Tanzania
18 *Rufoclanis erlangeri* R. & J. ♂, Somalia (Type, BM)
19 *Afrosphinx amabilis occidens* Clark ♂, Dodoma (Cotype, BM)
20 *Batocnema africana* Distant ♂, Tiwi, Kenya
21 *Likoma apicalis* R. & J. ♂, Mufindi, Tanzania
22 *Likoma crenata* R. & J. ♀, Kilifi, Kenya
23 *Poliodes roseicornis* R. & J. ♀, Mtito Andei, Kenya

Plate III

1 *Lophostethus demolini* Angas ♂, Gojeb river, Ethiopia
2 *Lophostethus negus* Jordan ♂, Gara Mullata, Ethiopia
3 *Ceridia heuglini* Felder ♂, Bwamba, Uganda
4 *Ceridia mira* R. & J. ♂, Isiolo, Kenya

5 *Afroclanis neavi neavi* Hampson ♂, Ilonga, Tanzania
6 *Afroclanis calcarea* R. & J. ♂, Vumba, Rhodesia
7 *Libyoclanis punctum* Rothschild ♂, Vumba, Rhodesia
8 *Libyoclanis metria* Jordan ♀, Abercorn, Zambia
9 *Libyoclanis illustris* R. & J. ♂, Bwamba, Uganda
10 *Neoclanis basalis* Walker ♂, Mtito Andei, Kenya
11 *Leucophlebia afra xanthopis* Hampson ♂, Mikumi, Tanzania
12 *Leucophlebia neumanni* Rothschild ♀, Blue Nile, Ethiopia (BM)
13 *Platysphinx constrigilis constrigilis* Walker ♂, Bwamba, Uganda
14 *Platysphinx stigmatica* Mabille ♂, Kibale forest, Uganda
15 *Leptoclanis pulchra* R. & J. ♂, Abercorn, Zambia

Plate IV

1 *Coelonia mauritii* Butler ♀, Nairobi, Kenya
2 *Callosphingia circe* Fawcett ♀, Voi, Kenya
3 *Poliana buchholzi* Plotz ♂, Kibale forest, Uganda
4 *Macropoliana ferax* R. & J. ♀, Kikuyu Escarpment, Kenya
5 *Poliana micra* R. & J. ♂, Mtito Andei, Kenya
6 *Poliana witgensi* Strand, ♀, Mtito Andei, Kenya
7 *Xanthopan morgani morgani* Walker ♂, Budongo forest, Uganda
8 *Praedora leucophaea* Rothschild ♂, Ikutha, Kenya (Type, BM)
9 *Macropoliana natalensis* Butler ♂, Amani, Tanzania
10 *Dovania poecila* R. & J. ♂, Kalinzu forest, Uganda
11 *Dovania neumanni* Jordan ♂, Adola, Ethiopia
12 *Pemba favillacea* Walker ♂, Abercorn, Zambia
13 *Pemba jordani* Joicey & Talbot ♀, Fort Crampel, French Congo (Type, BM)
14 *Praedora plagiata* R. & J. ♂, Southern Rhodesia, (BM)
15 *Praedora marshalli tropicalis* R. & J. ♀, Budongo forest, Uganda
16 *Litosphingia corticea* Jordan ♀, Fort Victoria, Rhodesia

Plate V

1 *Cephonodes hylas virescens* Wallengren ♂, Nairobi, Kenya
2 *Sphingonaepiopsis ansorgei* Rothschild ♀, Kolwezi, Katanga, Congo
3 *Sphingonaepiopsis nana* Boisduval ♀, Amani, Tanzania
4 *Macroglossum trochilus trochilus* Hübner ♂, Mt. Elgon, Kenya
5 *Leucostrophus hirundo* Gerstecker ♂, Kondoa, Tanzania
6 *Atemnora westermanni* Boisduval ♂, Kayonza, Uganda
7 *Antinephele achlora* Holland ♀, Budongo forest, Uganda
8 *Antinephele anomala camerunensis* Clark ♂, Entebbe, Uganda
9 *Antinephele marcida* Holland ♀, Budongo forest, Uganda
10 *Antinephele lunulata* R. & J. ♂, Kilosa, Tanzania (BM)
11 *Antinephele maculifera* Holland ♂, Entebbe, Uganda
12 *Temnora fumosa fumosa* Walker ♂, Entebbe, Uganda
13 *Temnora albilinea* Rothschild ♂, Mweya, Uganda
14 *Temnora marginata marginata* Walker ♂, Gazi forest, Kenya
15 *Temnora atrofasciata* Holland ♂, Cameroons (BM)
16 *Temnora atrofasciata* Holland ♀, Tchimbulu, Kasai, Congo
17 *Temnora griseata* R. & J. ♂, Katera, Sango Bay, Uganda
18 *Temnora griseata* R. & J. ♂, Tukuyu, Tanzania (BM)
19 *Temnora livida* Holland ♂, Lomela, Congo
20 *Temnora fenebris* Holland ♂, Katera, Sango Bay, Uganda

21 *Temnora elisabethae* Hering ♂, Kabanyolo, Kampala, Uganda
22 *Temnora subapicalis* R. & J. ♂, Limuru, Kenya
23 *Temnora eranga* Holland ♂, Budongo forest, Uganda
24 *Temnora scitula* Holland ♂, Fort Portal, Uganda
25 *Temnora iapygoides pernix* Kernbach ♂, Amani, Tanzania
26 *Temnora rattrayi* Rothschild ♂, Katera, Sango Bay, Uganda
27 *Temnora elegans* Rothschild ♂, Nairobi, Kenya
28 *Temnora sardanus* Walker ♂, Amani, Tanzania
29 *Temnora crenulata* Holland ♂, Budongo forest, Uganda
30 *Temnora curtula* R. & J. ♂, Entebbe, Uganda
31 *Temnora natalis* Walker ♂, Ruwe, Katanga, Congo

Plate VI

1 *Temnora spiritus* Holland ♂, Katera, Sango Bay, Uganda
2 *Temnora plagiata fuscata* R. & J. ♂, Nairobi, Kenya
3 *Temnora plagiata trapezoidea* Clark ♀, Budongo forest, Uganda (BM)
4 *Temnora hollandi* Clark ♀, Mawakota, Uganda (BM)
5 *Temnora zantus apiciplaga* Karsch ♀, Kakamega, Kenya
6 *Temnora mirabilis* Talbot ♀, Hoey's Bridge, Kenya (Holotype, BM)
7 *Temnora pseudopylas pseudopylas* Rothschild ♂, Nairobi, Kenya
8 *Temnora pylades pylades* R. & J. ♂, Vumba, Rhodesia
9 *Hypaedalia butleri* Rothschild ♂, Entebbe, Uganda
10 *Nephele monostigma* Clark ♂, Kibale forest, Uganda
11 *Nephele funebris* Fabricius ♂, Thego river, Kenya
12 *Nephele discifera* Karsch ♀, Kamengo, Uganda
13 *Nephele xylina* R. & J. ♂, Dire Dawa, Ethiopia
14 *Nephele bipartita* Butler ♂, Amani, Tanzania
15 *Nephele comma* Hopffer ♀, Amani, Tanzania
16 *Nephele vau* Walker ♂, Mufindi, Tanzania
17 *Nephele peneus* Cramer ♂, Mufindi, Tanzania
18 *Nephele lannini* Jordan ♀, Mufindi, Tanzania
19 *Nephele accentifera accentifera* Beauvois ♀, Mt. Kenya
20 *Nephele aequivalens* Walker ♂, Amani, Tanzania

Plate VII

1 *Nephele rectangulata* Rothschild ♂, Budongo forest, Uganda
2 *Nephele rosae illustris* Jordan ♂, Amani, Tanzania
3 *Nephele oenopion continentis* R. & J. ♂, Kamengo, Uganda
4 *Nephele argentifera* Walker, ♂, Amani, Tanzania
5 *Euchloron megaera megaera* L. ♂, Kakamega, Kenya
6 *Chaerocina dohertyi dohertyi* R. & J. ♂, Fort Hall, Kenya
7 *Chaerocina jordani* Berio ♂, Adola, Ethiopia
8 *Chaerocina ellisoni* Hayes ♂, Harar, Ethiopia (Holotype, BM)
9 *Rhodafra marshalli* R. & J. ♂, Mbeya, Tanzania
10 *Basiothia medea* Fabricius ♀, Nairobi, Kenya
11 *Basiothia charis* Boisduval ♀, Vumba, Rhodesia
12 *Basiothia aureata* Karsch ♀, Nakuru, Kenya
13 *Hippotion socotrense socotrense* Rebel ♂, Socotra
14 *Hippotion roseipennis* Butler ♀, Isiolo, Kenya
15 *Hippotion pentagramma* Hampson ♂, Dire Dawa, Ethiopia (BM)
16 *Hippotion rebeli* R. & J. ♂, Kinna, Kenya
17 *Hippotion socotrense diyllus* Fawcett ♀, Mtito Andei, Kenya

Plate VIII

1 *Hippotion celerio* L. ♀, Aberdares, Kenya
2 *Hippotion aporodes* R. & J. ♂, Budongo forest, Uganda
3 *Hippotion eson* Cramer ♂, Gabon
4 *Hippotion osiris* Dalman ♂, Dire Dawa, Ethiopia
5 *Hippotion eson* x *celerio* ♀, Nyeri, Kenya
6 *Hippotion chloris* R. & J. ♂, Njoro, Kenya (Type, BM)
7 *Hippotion balsaminae* Walker ♀, Amani, Tanzania
8 *Hippotion irregularis* Walker ♂, Amani, Tanzania
9 *Hippotion rosae rosae* Butler ♂, Mombasa, Kenya
10 *Hippotion stigma* R. & J. ♀, Walas Did, Kenya
11 *Hippotion moorei* Jordan ♂, Mtito Andei, Kenya
12 *Theretra capensis* L. ♂, Mufindi, Tanzania
13 *Theretra jugurtha* Boisduval ♂, Makerere, Uganda
14 *Theretra monteironis* Butler ♂, Mtito Andei, Kenya
15 *Theretra perkeo* R. & J. ♂, Kaolak, Senegal
16 *Centroctena rutherfordi* Druce ♂, Kakamega, Kenya
17 *Centroctena imitans* Butler ♂, Kwale, Kenya
18 *Theretra orpheus orpheus* Herrich-Schaffer ♂, Amani, Tanzania

Plate IX

1 *Chloroclanis virescens tanzanica* ssp. nov. ♂, Amani, Tanzania (Paratype)
2 *Chloroclanis virescens tanzanica* ssp. nov. ♀, Amani, Tanzania (Allotype)
3 *Falcatula tamsi* sp. nov, ♂, Harar, Ethiopia (Holotype, BM)
4 *Rufoclanis maccleeryi* sp. nov. ♂, Lindi, Tanzania (Holotype, BM)
5 *Neopolyptychus compar septentrionalis* ssp. nov. ♂, Amani, Tanzania (Paratype)
6 *Polyptychus ? nigriplagus* R. & J. ♀, Lake Tumba, Congo
7 *Neopolyptychus serrator commodus* Jordan ♀, Entebbe, Uganda (Neallotype, BM)
8 *Polyptychus rougeoti* sp. nov. ♂, Lastourville, Gabon (Holotype, PM)
9 *Polyptychus andosus amaniensis* ssp. nov, ♂, Amani, Tanzania (Paratype)
10 *Chaerocina dohertyi meridionalis* ssp. nov. ♀, Mufindi, Tanzania (Paratype)

Plate X

1 *Hippotion rosae guichardi* ssp. nov. ♂, Socotra (Holotype, BM)
2 *Hippotion rosae guichardi* ssp. nov. ♀, Socotra (Allotype, BM)
3 *Temnora robertsoni* sp. nov. ♂, Mlingano, Tanzania (Holotype, BM)
4 *Temnora scheveni* sp. nov. ♂, Kalinzu forest, Uganda (Paratype)
5 *Libyoclanis oweni* sp. nov. ♂, Freetown, Sierra Leone (Holotype, BM)
6 *Temnora burdoni* sp. nov. ♂, Mufindi, Tanzania (Holotype, BM)
7 *Ellenbeckia monospila* R. & J. ♀, Mandera, Kenya
8 *Libyoclanis goodi* Holland ♂, Gabon (Paris); photo P. C. Rougeot
9 *Ellenbeckia monospila* R. & J. ♂, Wajir, Kenya

Plate XI (genitalia)

1 *Polyptychus andosus amaniensis* ssp. nov, ♂, Amani, Tanzania
2 *Polyptychus andosus tiro* Kernbach ♂, Lomela, Congo
3 *Polyptychus rougeoti* sp. nov. ♂, Lastourville, Gabon (Paratype)
4 *Neopolyptychus serrator commodus* Jordan ♂ Bukoba, Tanzania (BM)
5 *Neopolyptychus convexus* R. & J. ♂, Kolwezi, Katanga, Congo
6 *Neopolyptychus compar compar* R. & J. ♂, Vumba, Rhodesia

7 *Neopolyptychus prionites* R. & J. ♂, Nyabyeya, Uganda
8 *Polyptychoides grayi grayi* Walker ♂, Natal, South Africa
9 *Microclanis erlangeri* R. & J. ♂, Voi, Kenya
10 *Polyptychopsis marshalli auriguttata* Gehlen ♂, Kolwezi, Katanga, Congo
11 *Gynoeryx meander* Guenee ♂, Madagascar
12 *Chloroclanis virescens tanzanica* ssp. nov. ♂, Amani, Tanzania
13 *Pseudopolyptychus foliaceus* R. & J. ♂, Ghana, (BM)
14 *Malgassoclanis delicata* Jordan ♂, Madagascar (BM)
15 *Andriasa contraria contraria* Walker ♂, Mombasa, Kenya
16 *Afroclanis neavi neavi* Hampson ♂, Ukiriguru, Tanzania
17 *Pseudandriasa mutata* Walker ♂, Natal, South Africa (BM)

Plate XII (genitalia)

1 *Neoclanis basalis* Walker ♂, Ilonga, Tanzania
2 *Lophostethus negus* Jordan ♂, Gara Mullata, Ethiopia
3 *Chloroclanis virescens tanzanica* ssp. nov, ♀, Amani, Tanzania (Allotype)
4 *Leptoclanis pulchra* R. & J. ♂, Kolwezi, Katanga, Congo
5 *Libyoclanis oweni* sp. nov. ♂, Freetown, Sierra Leone (Holotype, BM)
6 *Falcatula falcata* R. & J. ♀, Kitale, Kenya
7 *Neopolyptychus serrator commodus* Jordan ♀, Uganda
8 *Leptoclanis pulchra* R. & J. ♀, Katanga, Congo
9 *Afrosphinx amabilis amabilis* Jordan ♀, N.W. Zambia (BM)
10 *Polyptychopsis marshalli marshalli* R. & J. ♀, Umtali, Rhodesia
11 *Microclanis erlangeri* R. & J. ♀, Merti, Kenya

Plate XIII (genitalia)

1 *Polyptychoides grayi niloticus* Jordan ♀, Shinyanga, Tanzania(BM)
2 *Rufoclanis fulgurans* R. & J. ♀, Ilonga, Tanzania
3 *Afroclanis calcarea* R. & J. ♀, Fort Victoria, Rhodesia
4 *Polyptychus nigriplagus* R. & J. ♀, Lake Tumba, Congo
5 *Neoclanis basalis* Walker ♀, Lake Rukwa, Tanzania
6 *Macropoliana ferax* R. & J. ♀, Kikuyu Escarpment, Kenya
7 *Ellenbeckia monospila* R. & J. ♀, Wajir, Kenya
8 *Sphingonaepiopsis nana* Boisduval ♂, Mombasa, Kenya
9 *Sphingonaepiopsis ansorgei* Rothschild ♂, Abercorn, Zambia
10 *Poliana buchholzi* Plotz ♂, Kibale forest, Uganda
11 *Poliana witgensi* Strand ♂, Mtito Andei, Kenya
12 *Macropoliana ferax* R. & J. ♂, Nairobi, Kenya

Plate XIV (genitalia)

1 *Temnora burdoni* sp. nov. ♂, Mufindi, Tanzania (Holotype, BM)
2 *Temnora scheveni* sp. nov. ♂, Kalinzu forest, Uganda (Paratype)
3 *Leucostrophus hirundo* Gerstecker ♂, Ruiru, Kenya
4 *Hypaedalia butleri* Rothschild ♂, Kamengo, Uganda
5 *Temnora robertsoni* sp. nov. ♂, Mlingano, Tanzania (Holotype, BM)
6 *Antinephele achlora* Holland ♂, Kamengo, Uganda
7 *Nephele xylina* R. & J. ♂, Dire Dawa, Ethiopia
8 *Sphingonaepiopsis nana* Boisduval ♀, Ukerewe island, Tanzania
9 *Hypaedalia butleri* Rothschild ♀, Moyamba, Sierra Leone (BM)
10 *Temnora eranga* Holland ♀, Ikom, Nigeria (BM)

11 *Antinephele achlora* Holland ♀, Kamengo, Uganda
12 *Temnora iapygoides iapygoides* Holland ♀, Sierra Leone (BM)
13 *Pemba jordani* Joicey & Talbot ♀, French Congo (Type, BM)
14 *Sphingonaepiopsis ansorgei* Rothschild ♀, Abercorn, Zambia

Plate XV (genitalia)

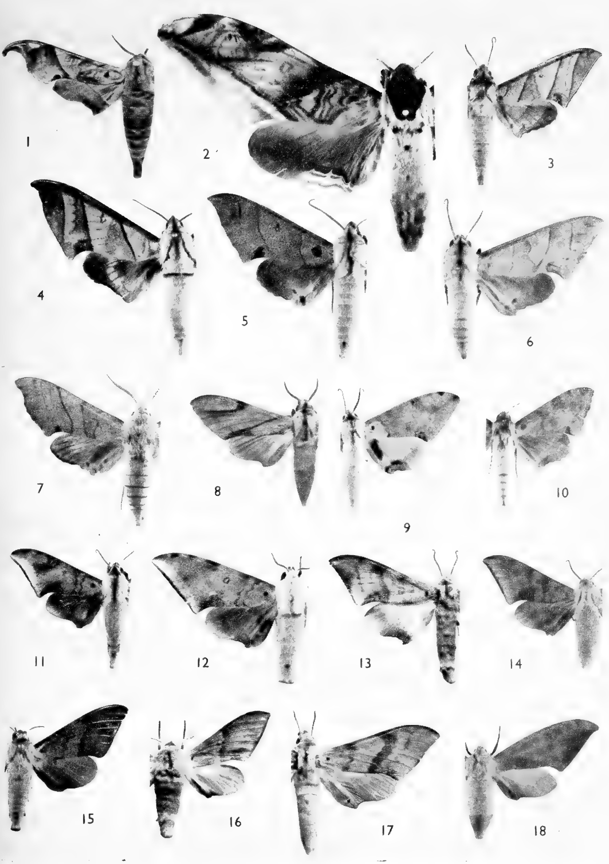
1 *Hippotion moorei* Jordan ♂, Melka Murri, Kenya
2 *Hippotion aporodes* R. & J. ♂, Kibale forest, Uganda
3 *Hippotion irregularis* Walker ♂, Kapsabet, Kenya
4 *Hippotion rosae guichardi* ssp. nov. ♂, Socotra (Holotye, BM)
5 *Hippotion socotrense diyllus* Fawcett ♂, Mtito Andei, Kenya
6 *Hippotion socotrense socotrense* Rebel ♂, Socotra
7 *Hippotion stigma* R. & J. ♂, Kenya (BM)
8 *Basiothia aureata* Karasch ♂, Nyakasura, Uganda
9 *Centroctena imitans* Butler ♂, Mombasa, Kenya
10 *Theretra jugurtha* Boisduval ♂, Amani, Kenya
11 *Chaerocina jordani* Berio ♂, Gojeb, Ethiopia
12 *Leucostrophus hirundo* Gerstecker ♀, Embu, Kenya
13 *Basiothia aureata* Karsch ♀, Kibale forest, Uganda
14 *Hippotion socotrense diyllus* Fawcett ♀, Mtito Andei, Kenya
15 *Hippotion aporodes* R. & J. ♀, Kibale forest, Uganda
16 *Rhodafra marshalli* R. & J. ♀, Ngurdoto crater, Tanzania

Plate XVI (genitalia and early stages)

1 *Chaerocina dohertyi dohertyi* R. & J. ♀, Nyakasura, Uganda
2 *Theretra capensis* L. ♀, Mufindi, Tanzania
3 *Centroctena rutherfordi* Druce ♀, Kamengo, Uganda
4 *Hippotion moorei* Jordan ♀, Hargeisa, Somalia
5 *Xanthopan morgani morgani* Walker, larva, Mombasa, Kenya (photo D. G. Sevastopulo)
6 *Xanthopan morgani morgani* Walker, pupa, Mombasa, Kenya (photo D. G. Sevastopulo)
7 *Basiothia aureata* Karsch, larva, Mombasa, Kenya (photo D. G. Sevastopulo)
8 *Basiothia aureata* Karsch, pupa, Mombasa, Kenya (photo D. G. Sevastopulo)

Plate XVII (genitalia)

1 *Cephonodes hylas virescens* Wallengren ♂
2 *Rufoclanis maccleeryi* sp. nov. ♂, Lindi, Tanzania (Holotype, BM)
3 *Hippotion chloris* R. & J. ♂, Njoro, Kenya (Type, BM)
4 *Pemba jordani* Joicey & Talbot ♂, Tororo, Uganda (BM)
5 *Afrosphinx amabilis occidens* Clark ♂, Dodoma, Tanzania (Cotype, BM)
6 *Falcatula tamsi* sp. nov. ♂, Harar, Ethiopia (Holotype, BM)



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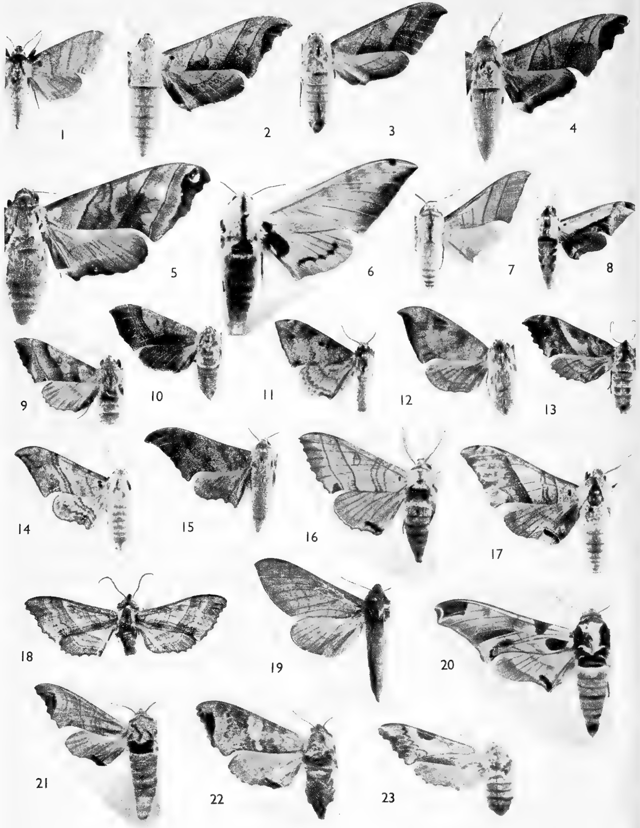

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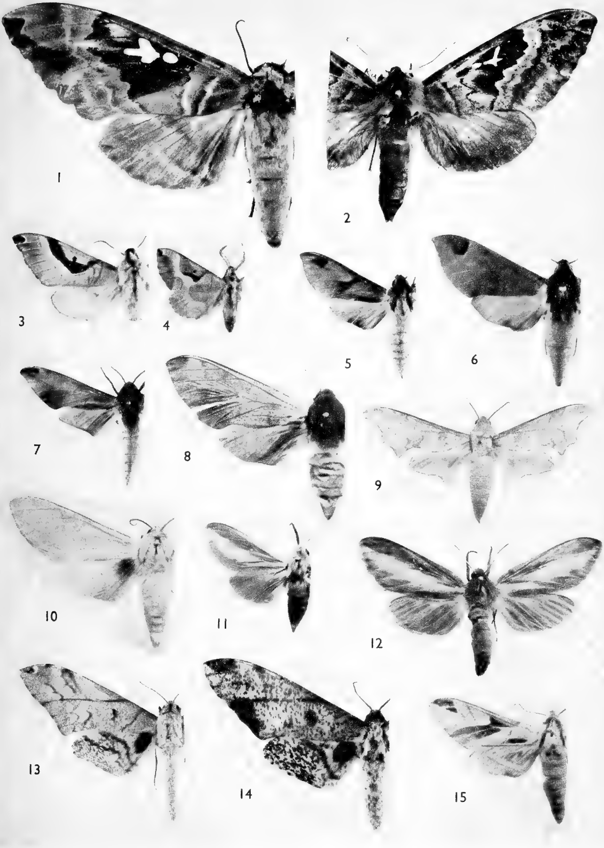

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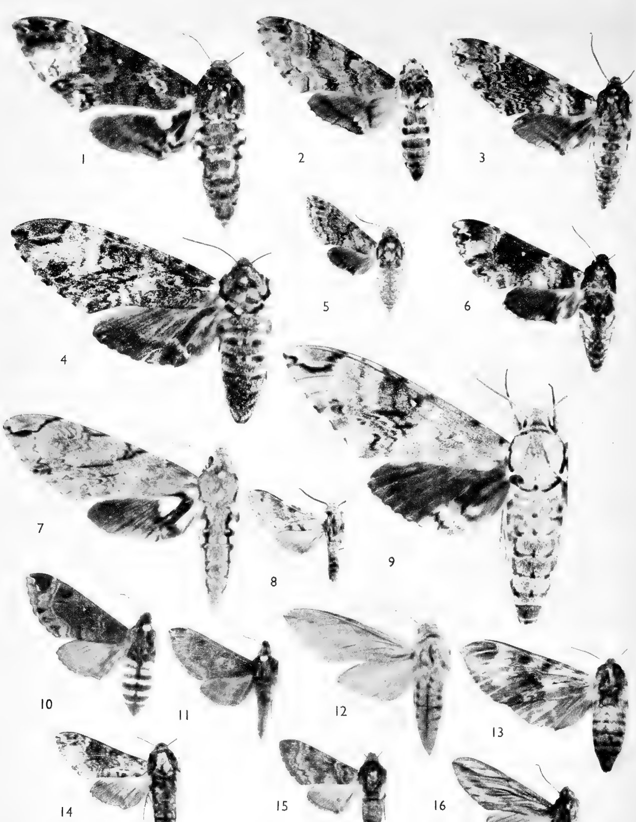

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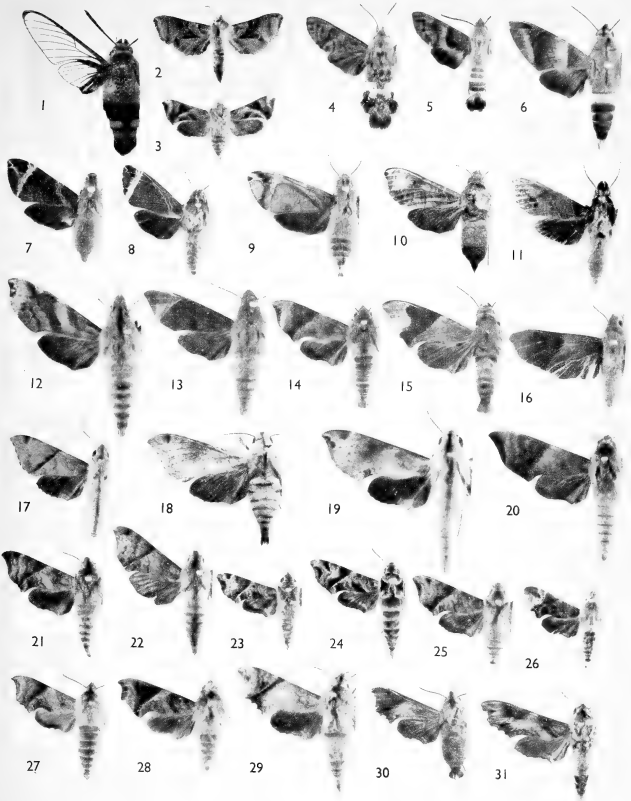
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Plate V

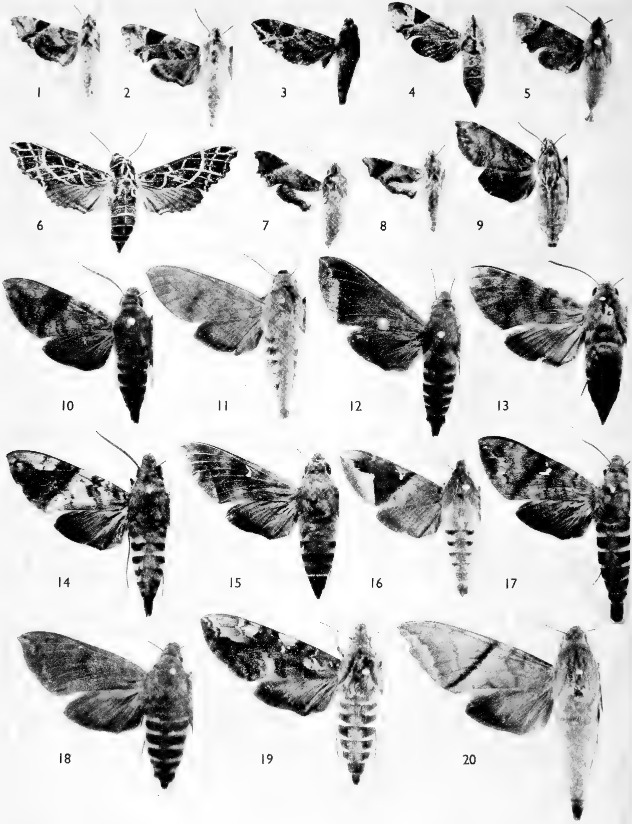
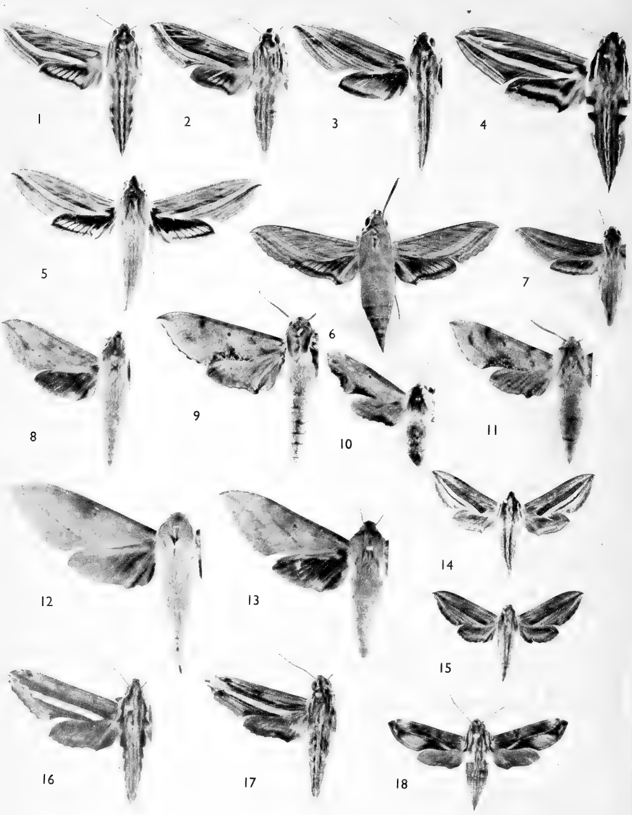


Plate VI

Plate VII



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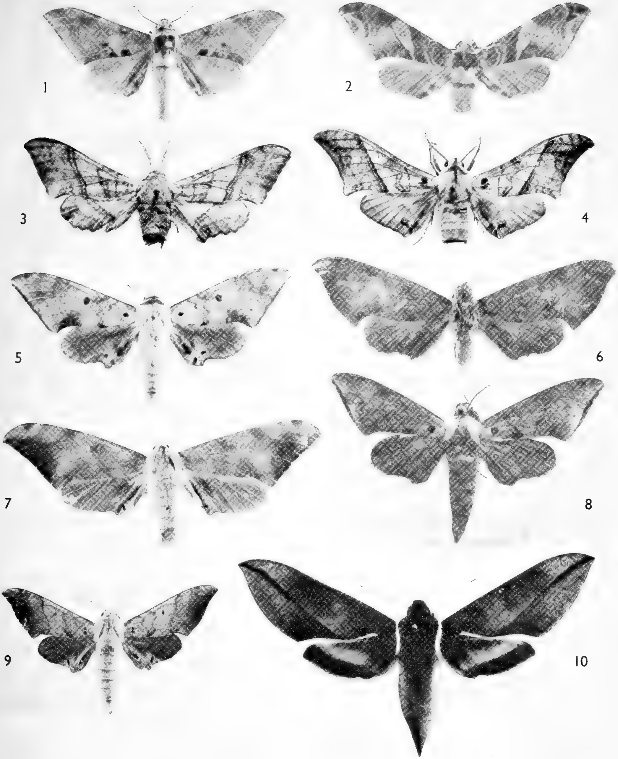

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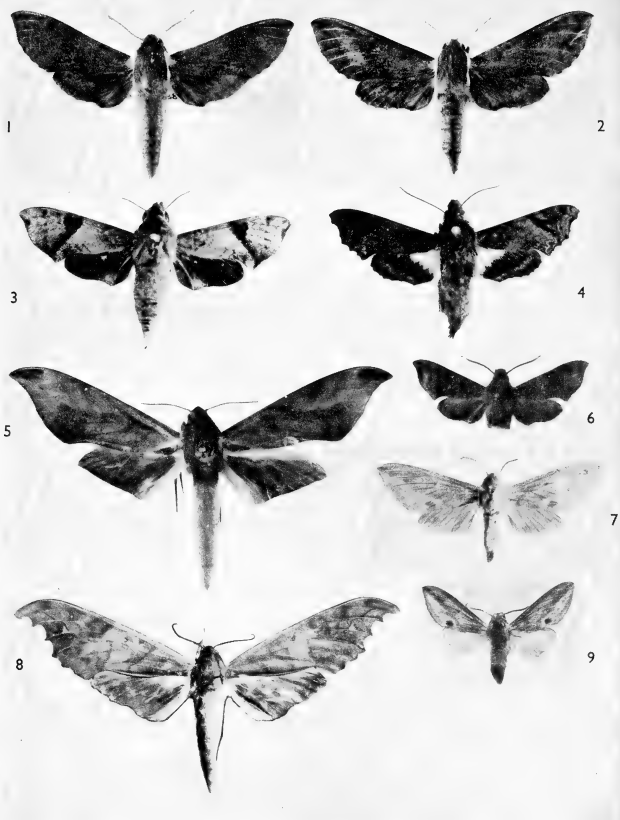

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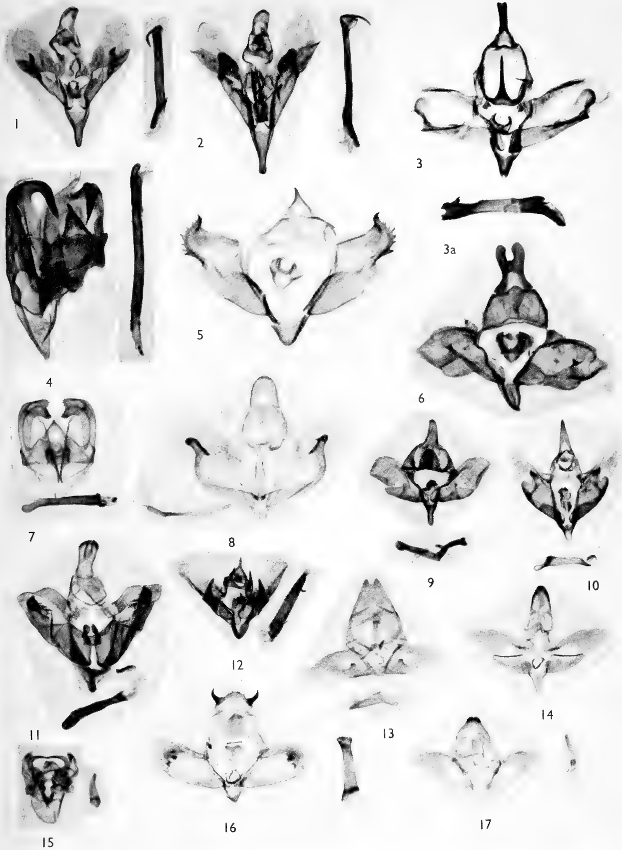

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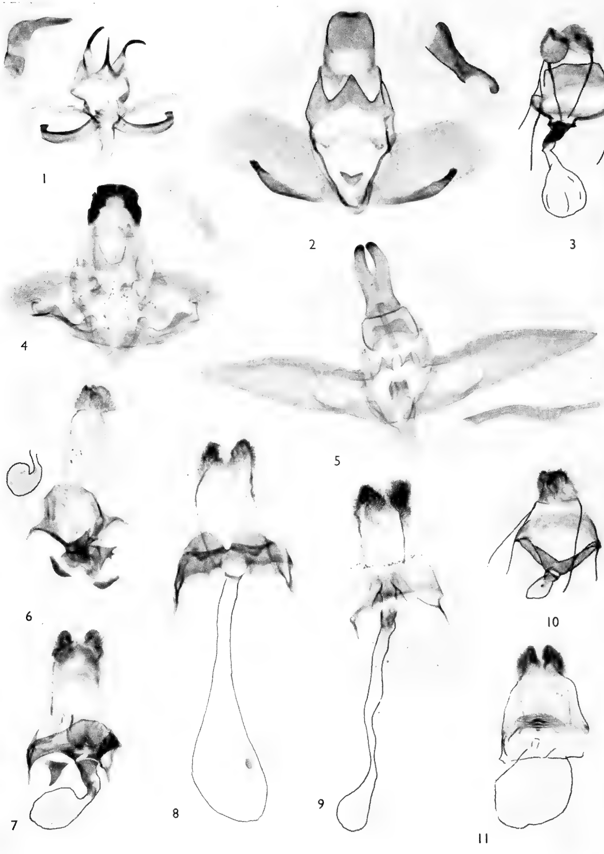

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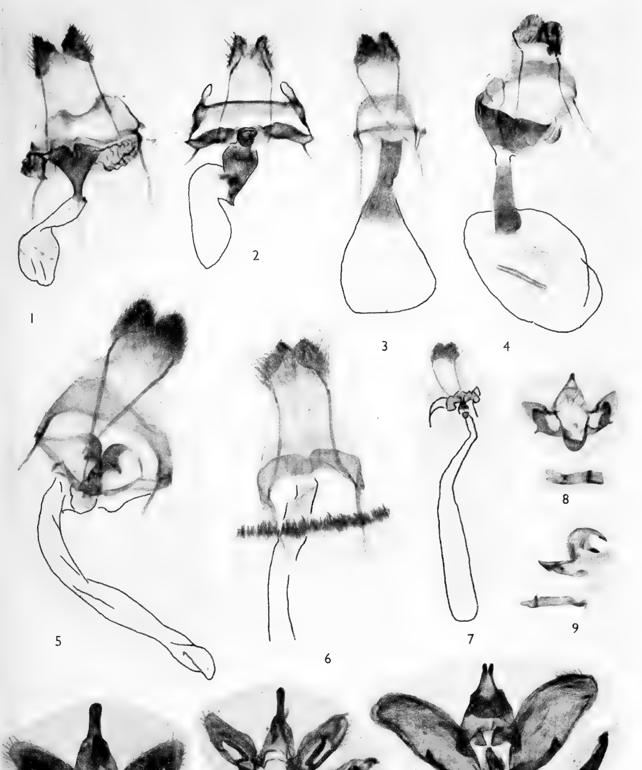

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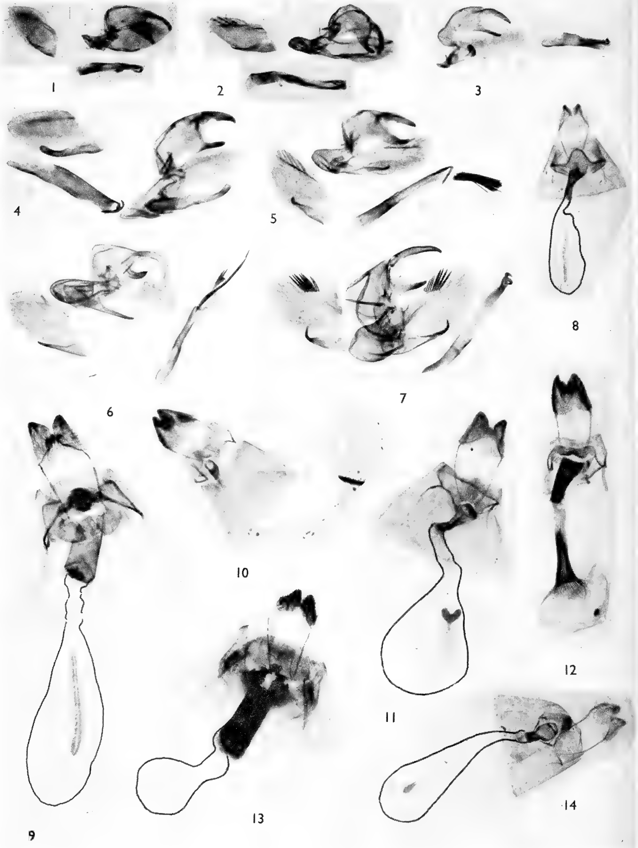

Plate XIV

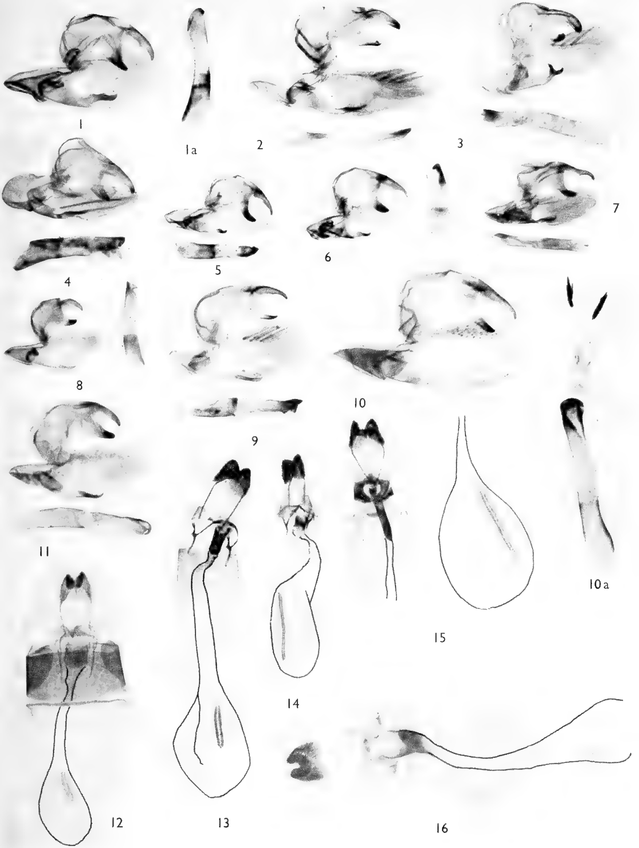

Plate XV

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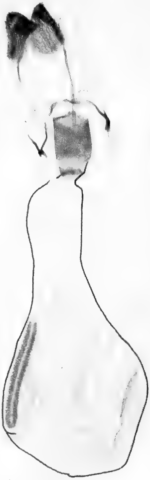

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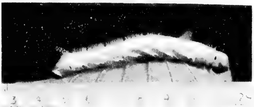

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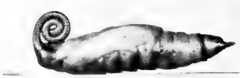

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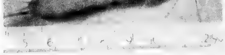

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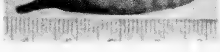

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Plate XVI

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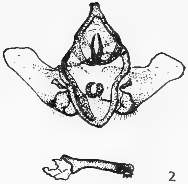

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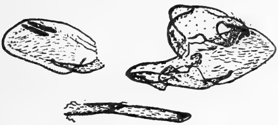

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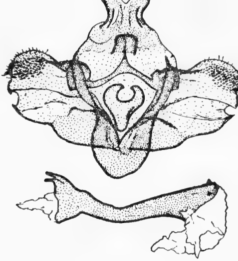

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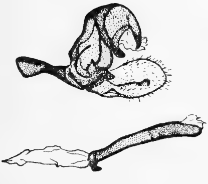

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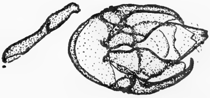

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Plate XVII

TANZANIA	NM	:	Amani, Ukerewe, Lyamungu, Mufindi.
	RJ	:	Mikindani.
	R	:	Ilonga, Tabora, Mlingano, Mbeya, Arusha.
	MC	:	Lindi, Songea.
ETHIOPIA	NM	:	Neghelli, Adola.

COELONIA SOLANI (Boisduval) 1833.
Sphinx solani Boisduval *Faune Madag. & Bourbon:* 76 (Bourbon and Mauritius).
1875 *Sphinx astaroth* Boisduval *Spec. Gen. Lep. Het.* **1:** 85 (? Brasil).
1875 *Protoparce fulvinotata* Butler *Proc. zool. Soc. Lond.* : 11 (supposed to be from South Africa according to Butler's description but specimen without readable data) syn. nov.

Ssp. *solani.*
Mauritius, Bourbon and Madagascar.

Ssp. *comoroana* Clark 1927.
Proc. New Engl. zool. Cl. **9:** 99 (Comoro Islands) Comoro Islands only.

COELONIA BREVIS R. & J. 1915.
Novit. zool. **22:** 28 (Madagascar only).

CALLOSPHINGIA R. & J. 1916

Novit. zool. **23:** 247; type species: *Dovania circe* Fawcett 1915.
Proboscis long. Antennae straight and strongly hooked, more slender in ♀. Tibiae spineless, tarsi spinose. 1 pair of midtibial spurs. Pulvillus present, paronychium with a single lobe on each side. Vein 6 of hw stalked. 6 and 7 of hw free, cell very short. For genitalia and early stages see *C. circe* Fawcett.

CALLOSPHINGIA CIRCE (Fawcett) 1915. (IV; 2)
Dovania circe Fawcett *Proc. zool. Soc. Lond.* : 106 (Kedai, Kenya).

Sexes similar in appearance. Fw. 29–36 mm. Fw. light greyish brown, with numerous wavy transverse lines and mottled with light reddish brown, slightly darker in ♀. Stigma small, whitish. Head and abdomen light reddish brown, thorax darker. Two short blackish lines at base of abdomen. Hw light coppery, darker at the margin.
♂ GENITALIA: uncus downcurved, with a strongly sclerotised terminal hook. Gnathos a blunt plate, more prominent than in previous three genera. Saccus fairly short and slender. Valve rhomboid, apically lanceolate, inner surface with numerous stout setae, particularly near distal margin. Harpe ventro-basal, armed with two long upward curved terminal hooks. Aedeagus short and straight, pointed apically.

♀ GENITALIA: vaginal plate divided mesially by prominent funnel-shaped operculum. Ductus a short sclerotised tube followed by a longer membranous one. Bursa very elongated, membranous. Signum near distal end of ductus, a rather large heart-shaped plate. Struts long and flattened.
EARLY STAGES: unknown.
Adult nocturnal.

HABITAT AND RANGE

Semi-desert and arid scrub throughout eastern Africa.

EAST AFRICAN RECORDS

KENYA	NM :	Isiolo, Voi, Mtito Andei, Kinna (N.F.D.).
	BM :	Mbololo, Kibwezi, Makindu, Kedai.
TANZANIA	BM :	Arusha.
	NM :	Mlingano.
SOMALIA	NM :	Durksi, Northern Region.
ETHIOPIA	BE :	Uarder.

Subtribe SPHINGES

XANTHOPAN R. & J. 1903

Novit. zool. **9** *suppl.* : 30; type species *Macrosila morgani* Walker 1856.

Proboscis extremely long. Antennae slender and hooked, inner surface of second palpal segment hollow, but covered by normal scales. Last segment of palpus with a spine-like lateral apical projection. Tibiae spineless, tarsi spinose. Midtibiae with a single pair of spurs, the outer one much longer than the inner; hindtibiae with 2 pairs, the outer ones very long. Hindtarsus with a comb of bristles at base of first segment. Pulvillus present, paronychium with two lobes on each side. Cell of hw very short.

XANTHOPAN MORGANI (Walker) 1856.

Macrosila morgani Walker *List. Lep. Ins. B.M.* **8**: 206 (Sierra Leone).

Ssp. *morgani*. (IV; 7—XVI; 5,6)

A very large moth, rather similar to *Coelonia mauritii* Butler, but wings broader, body more slender. ♂: fw. 54–56 mm. Fw. termen straight with slight inter-nervular crenulations from apex to vein 4, slightly emarginated from vein 4 to tornus, which is rather rounded. Forewing olive brown mottled with brown and marked with black. Stigma whitish, conspicuous. Body olive brown above, whitish below. Two black lines on thorax and a series of paired black subdorsal lines on each abdominal segment. A pair of yellow lateral spots on the first 3 abdominal segments. Hw very dark brown with a large yellow basal area interrupted by a broad blackish stripe from base to tornus.

♀: similar to ♂, but larger; fw. 57–68 mm., antennae more slender.

GENITALIA: postvaginal plate rounded posteriorly, entire vaginal plate consisting of two elongated plates on either side of operculum. Operculum with a deep oblique ventral sinus. Ductus long and membranous. Bursa large, membranous, laterally dilated on one side. Signum near base of bursa, a lanceolate spinose plate. Struts long.

EARLY STAGES

LARVA: body clothed in fuzz of white setae. Head and body blue green. A series of 7 white Vs with apices on dorsum, pointing backwards. Spiracles black surrounded by a white ring. Horn stout, black, armed with pale lilac spines, slightly downcurved. Legs deep pink, ringed basally with black. Prolegs green with a black band. Claspers broadly edged with black. Anal flap vermilion, black tipped. Immediately before pupation it develops a series of orange shield-shaped dorsal markings.

PUPA: subterranean, chestnut, with the usual pear-shaped subdorsal patches on metathorax. A raised ridge between 7th and 8th abdominal somites. Proboscis sheath free, forming a spiral of two complete coils.
FOOD PLANTS: *Anona senegalensis* Pers. and *Uvaria* sp. (Anonaceae).

HABITAT AND RANGE
Forest and woodland throughout tropical Africa, up to 6,000 ft.
EAST AFRICAN RECORDS

KENYA	NM :	Shimba Hills, Kakamega.
	S :	Mombasa.
	SM :	Istsare.
	ESB :	Muguga.
UGANDA	NM :	Masaka, Kalinzu, Budongo, Fort Portal.
	BM :	Kampala, Entebbe, Bwamba, Bungoma.
	B :	Nakawa.
	L :	Mweya.
TANZANIA	NM :	Amani, Ukerewe.
	R :	Ilonga, Mbeya, Mlingano, Tabora.
	BM :	Dar es Salaam, Pemba, Kigoma.

Ssp. *praedicta* R. & J. 1903.
Novit. zool. **9** *suppl.* : 32 (Madagascar, ♂).
Madagascar only.

PANOGENA R. & J. 1903

Novit. zool. **9** *suppl.* : 33; type species *Sphinx jasmini* Boisduval 1875.

PANOGENA JASMINI (Boisduval) 1875.
Sphinx jasmini Boisduval *Spec. Gen. Lep. Het.* **1**: 114 (Tananarivo, Madagascar).
1877 *Diludia chromapteris* Butler *Proc. zool. Soc. Lond.* : 168 (Madagascar).
Madagascar only.

PANOGENA LINGEUS (Butler) 1877.
Protoparce lingeus Butler *Proc. zool. Soc. Lond.* : 169 (Madagascar).
Madagascar only.

POLIANA R. & J. 1903

Novit. zool. **9** *suppl.* : 38; type species *Sphinx buchholzi* Plötz 1880.
1910 *Taboribia* Strand *Ann. Soc. ent. belge* **54**: 228; type species *Taboribia witgensi* Strand 1910.

Small to medium sized grey moths.
Proboscis not longer than body. Antennae long, slender, hooked. Tarsi spinose. Foretibia with a few strong lateral spines; mid and hindtibiae spineless, but tibial spurs, (one pair on midtibiae and two pairs on hindtibiae), very long; tarsal comb absent; pulvillus and paronychium present. Vein 6 of fw free, veins 6 and 7 of hw stalked; hw cell very short; a shallow pocket like swelling in spaces 6 and 7 of fw. Uncus undivided; harpe not at ventral margin of valve, but in a cavity in the lower half of valve. Aedeagus without apical spine; modified scales forming a narrow erect longitudinal crest on outer surface of valve.

POLIANA BUCHHOLZI (Plötz) 1880. **(IV; 3—XIII; 10)**
Sphinx buchholzi Plötz *Stett. ent. Zeit.* **41:** 76 (Benjongo, West Africa).
1882 *Protoparce laucheana* Druce *Ent. mon. Mag.* **19:** 18 (West Africa).
1887 *Protoparce weiglei* Möschler *Abh. senckenb. naturf. Ges.* **15:** 70 (Accra, Gold Coast).

Sexes indentical superficially. Fw. 41–45 mm., olive grey, variously mottled with whitish and transversely banded with numerous crenulate blackish lines. Stigma whitish, prominent. Hw grey, whitish near tornus and inner margin. Body olive grey above, mottled with whitish and blackish, pink below. Two ochreous yellow hair tufts bordered with black near base of abdomen above.
♂ GENITALIA: uncus narrow, slightly downcurved, keeled below. Gnathos very strongly sclerotised, narrow and prominent, with slight mesial indentation at apex. Saccus short and broad. Valve long and narrow, hairy. Harpe a broad plate with 4 or 5 strong spines pointing towards apex of valve, resting in a central cavity. Aedeagus short and straight. Vesica armed with 2 long, densely spinose flaps.

♀ GENITALIA: 8th tergite posteriorly bilobed. Postvaginal plate undivided. Ostium broad, unarmed. Posterior portion of ductus a small, rounded sclerotised, open-ended capsule; remainder of ductus very long, membranous. Bursa elongated, membranous. Signum near apex of bursa, a spinose plate shaped like a leaf, with a small membranous centre. Struts very long.
EARLY STAGES: unknown.

HABITAT AND RANGE
Forests from West Africa to Uganda and West Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Fort Portal, Budongo.
	SM :	Mombo.
	K :	Kawanda.

POLIANA WITGENSI (Strand) 1910 comb. nov. **(IV; 6—XIII; 11)**
Taboribia witgensi Strand *Ann. Soc. ent. belge* **54:** 228 (Tabora).
1915 *Poliana marmorata* Fawcett *Proc. zool. Soc. Lond.* : 105 (Kedai, Kenya).
1916 *Poliana buchholzi witgensi* Jordan *Novit. zool.* **23:** 248.
1930 *Poliana buchholzi marmorata* Hering in Seitz, "Macrolepidoptera of the World" **14:** 359.
1930 *Taboribia witgensi* Hering *l.c.* : 360.

Hering's re-instatement of *Taboribia* was due to a faulty interpretation of Jordan's diagnosis of *Poliana*, without reference to the type species, *P. buchholzi* (Plötz). Despite Jordan's opinion, *witgensi* cannot be regarded as a subspecies of *buchholzi* and must be treated as a good species owing to the fact that the two forms occupy entirely different habitats and exhibit constant genitalial differences.

Very similar to the previous species, but smaller and darker, groundcolour being almost blackish in fresh specimens, fading to chocolate in old specimens. Underside of thorax and abdomen white, not pink as in P. *buchholzi*. Sexes superfically identical. Fw. 34–40 mm.
♂ GENITALIA: similar to *P. buchholzi*, but harpe strap-shaped, with a single terminal hook, spinose flaps of vesica, shorter.

♀ GENITALIA: similar to *P. buchholzi*, but signum smaller, more rounded, without membranous centre and with larger teeth.
EARLY STAGES: unknown.

HABITAT AND RANGE
Savanna and dry bush from East Kenya and Tanzania to Rhodesia and Mozambique.
EAST AFRICAN RECORDS

KENYA	NM :	Malindi, Mombasa, Kilifi, Shimoni, Mtito Andei.
	BM :	Masongaleni, Kibwezi, Rabai.
TANZANIA	NM :	Tumbi, Tabora.
	R :	Mlingano, Dar es Salaam.
	BM :	Shinyanga.
	ESB :	Manyara.

POLIANA MICRA R. & J. 1903. (IV; 5)
Novit. zool. **9** *suppl.* : 809 (Ganale River, Somaliland ♂).

Very similar to some species of ***Praedora*** R. & J., but differs in the midtibiae and tibial spurs *not* being spinose. Sexes superficially identical. Fw. 22–28 mm. Body grey, mottled and faintly spotted with darker and lighter grey. Fw. grey with crenulated darker transverse lines, and a small whitish stigma. Hw. uniform grey.
♂ GENITALIA: uncus narrow, downcurved, heavily keeled ventrally, strongly sclerotised apically, with a small terminal hook. Gnathos strongly sclerotised, with two small terminal lobes. Saccus very short, rounded. Valve lanceolate; harpe a narrow blade terminating in 2 slender processes pointed distad. Aedeagus short, stout and straight. Vesica with two unarmed rugose flaps, very slightly sclerotised.

♀ GENITALIA: vaginal plate divided at ostium. Ductus entirely membranous, very wide and very long. Bursa elongated. Signum near middle of bursa, a small rounded, weakly sclerotised spinose plate with indefinite margins.
EARLY STAGES: unknown.

HABITAT AND RANGE
Arid scrub from Somalia to East Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Yatta, Mtito Andei, Makueni, Makindu, Ikutha, Gazi, Kitui, Voi.
	BM :	Voi, Kibwezi, Kedai, Rabai, Chanler Falls.
SOMALIA	BM :	(Type) Ganale River.

MACROPOLIANA gen. nov.

Large species which differ from *Poliana* R. & J. in having *all* the tibiae spineless.
Antennae thicker than in *Poliana*, venation as in *Poliana*. Uncus bilobed, harpe ventral, aedeagus with a terminal spine, vesica unarmed; modified scales rounded and appressed, not lanceolate and erect.
TYPE SPECIES: *Diludia natalensis* Butler 1875.

MACROPOLIANA NATALENSIS (Butler) 1875, comb. nov. (IV; 9)
Diludia natalensis Butler *Proc. zool. Soc. Lond.* : 13 (Natal).
1903 *Poliana natalensis* R. & J. *Novit. zool.* **9** *suppl.* : 40.

♂: fw. 55–70 mm., very pale grey with wavy blackish transverse bands and whitish stigma, termen somewhat concave before tornus. Two short longitudinal blackish streaks in centre of wing. Head pale grey. Thorax pale grey surrounded dorsally by black lines edged internally with yellow. Abdomen pale grey, mottled and faintly spotted with darker grey. Hw dark greyish brown, with a large pale grey patch near tornus. 3 specimens from Adola, Ethiopia, in NM, with much darker fw.

GENITALIA: uncus narrow, downcurved, deeply bifid. Gnathos a prominent blunt plate. Saccus very long and slender, curved to one side. Valve fairly long and rounded. Harpe ventral, a simple, apically rounded blade. Aedeagus long, slender, curved ventrad, with a broad-based apical spine on ventral surface.

♀: larger, forewing broader and less concave, usually darker and more heavily marked, 65–75 mm. GENITALIA: vaginal plate undivided. Ductus not very long, narrower at ostium, sclerotised. Bursa pear-shaped. Signum small, shaped like a compressed horse-shoe, tuberculate rather than spinose or dentate. Struts long.

EARLY STAGES

LARVA, 5TH INSTAR: head pale pinkish brown, with 2 olive brown stripes above, and a pale green lateral stripe on each side. Body pale green. A yellow dorsal stripe from 4th somite to base of horn. 7 oblique yellow dorsal stripes edged above with darker green. 5th to 11th somites with subdorsal purple spots speckled with white, largest on 5th somite, decreasing in size. 3rd somite with an anterior dorsal protuberance followed by a transverse series of 16 white tubercles. 4th somite with a transverse series of 6 white tubercles. Horn very small, downcurved, appressed to body, greenish-yellow. Spiracles purple, rimmed with white, and then with purple speckled with white. Legs yellow, apical point brown. Prolegs green, transversely banded with black. Anal flap and claspers yellowish with brown tubercles. Venter green. Clothed thickly with short, erect, colourless pubescence. Immediately before pupation the larva turns olive-purple, and the yellow stripe becomes very conspicuous.

PUPA: subterranean, dark brown, punctate. A narrow subdorsal scar-like mark on metathorax. Base of proboscis sheath projecting slightly ventrad. Cremaster conical, with a longitudinal ventral ridge.

FOOD PLANT: *Spathodea nilotica* Seem. (Bignoniaceae).

HABITAT AND RANGE

Forest and moist woodland from Natal to Ethiopia and westwards to the Cameroons, Ghana and Sierra Leone.

EAST AFRICAN RECORDS

KENYA	NM	:	Kakamega.
	BM	:	Rabai.
UGANDA	NM	:	Bwamba, Fort Portal.
	BM	:	W. Elgon.
	B	:	Nakawa.
TANZANIA	NM	:	Amani, Marangu, Arusha (Irving).
	BM	:	Bukoba.
	MC	:	Lindi, Songea.
ETHIOPIA	NM	:	Dire Dawa, Adola.

MACROPOLIANA FERAX (R. & J.) 1916 comb. nov., stat. nov. (IV; 4—XIII; 6,12)
Poliana natalensis ferax R. & J. *Novit. zool.* **23:** 247 (Manow, S. Tanzania).

Although treated as a subspecies of *M. natalensis* by R. & J. and by subsequent authors, *ferax* must be regarded as a good species for the following reasons: it overlaps *natalensis* in parts of its range, it occupies a different habitat, and the genitalia are consistently different. Very similar to *M. natalensis*, but smaller and darker, particularly in the ♀. Most specimens have a series of small paired yellow dorsal spots on the abdomen, which are lacking in *M. natalensis*. Fw. 45–52 mm.
♂ GENITALIA: uncus bifid, downcurved, heavily sclerotised apically. Gnathos membranous mesially. Saccus shorter than in *M. natalensis*, not bent to one side. Valve as in *natalensis*, but more hairy.

Harpe more slender proximally, dilated distally, terminating in an upcurved blunt point. Aedeagus straight, shorter and relatively stouter, apical spine more prominent, directed backwards.

♀ GENITALIA: vaginal plate much narrower than in *M. natalensis*. Ductus long and membranous. Bursa large, smooth, pear-shaped. Signum absent.
EARLY STAGES: unknown.

RANGE AND HABITAT
Highland forest in East Africa.
EAST AFRICAN RECORDS

KENYA	NM :	Molo, Ngong, Nairobi, Kikuyu Escarpment.
	SM :	Istsare, Elgon.
	BM :	Kinankop, Bura (Teita).
TANZANIA	R :	Mbeya, Arusha.

PEMBA R. & J. 1903

Novit. zool. **9** *suppl. :* 45; type species *Pemba distanti* R. & J. 1903.

Medium sized grey moths.
Proboscis rather short, palpus slender and elongated. Antennae short, slender and hooked. Foretibiae and tarsi with a few prominent external spines; midtibiae with a few apical spines; both pairs of hindtibial spurs set very close together. No tarsal comb. Pulvillus present, paronychium with a single slender lobe at each side, Vein 6 of fw free, veins 6 and 7 of hw stalked, Male genitalia without modified scales.

PEMBA FAVILLACEA (Walker) 1866. (IV; 12)
Anceryx favillacea Walker *List. Lep. Ins. B.M.* **35:** 1856 (Zambezi river, ♂).
1903 *Pemba distanti* R. & J. *Novit, zool.* **9** *suppl. :* 46 (Pemba island, ♂).

♂: fw. 34–39 mm. Head and thorax pale grey. Abdomen pale grey with a narrow dark dorsal line and a pair of blackish lateral spots on each segment. Fw, narrow and elongated, tornus not produced; pale grey lightly mottled with darker grey. Two short narrow black streaks in centre of wing, one at apex. Hw uniformly paler, with acute apex.

♀: larger (fw. 48 mm). Body and fw darker than in ♂, broader and more rounded. Hw more rounded, uniform grey, darker than fw.
GENITALIA: 8th tergite very lightly sclerotised, anterior margin bilobed. Ostium very wide. Ductus well sclerotised, particularly near ostium, long, with a sharp kink before entrance to bursa. Bursa long, apically rounded, without signa.

HABITAT AND RANGE
Savanna and bush from E. Kenya to Tanzania, Katanga, Zambia, Angola, Rhodesia and Mozambique.
EAST AFRICAN RECORDS

KENYA	NM :	Shimba Hills.
	S :	Mombasa.
TANZANIA	NM :	Ilonga, Mukuyu, Kigoma.
	R :	Tabora, Mlingano, Ukiriguru, Dar es Salaam.
	BM :	Pemba, Kilwa.
	MC :	Lindi, Songea.
ZAMBIA	NM :	Abercorn.

PEMBA JORDANI Joicey & Talbot 1916. (IV; 13—XIV; 13—XVII; 4)
Ann. Mag. nat. Hist. (8) **17:** 477 (Fort Crampel, Afrique Equatoriale Francaise, ♀).
1925 *Pemba cardinalli* Tams *Entomologist* **58:** 258 (Gold Coast, ♂) Smaller than previous species.

♂: body and forewing grey, with a wide, diffuse dark grey postmedial band and a dark diffuse spot at costa, near apex. Stigma small, round and whitish. Hw white with a small dark spot at tornus.

♀: larger, darker, wings broader than in ♂; hw dark grey.
GENITALIA: ostium opening on the same plane as the ventral surface of the abdomen, with a small posterior sinus and wider one on either side. Colliculum long and wide, rugose. Ductus very short, bursa small, rounded, pleated and unarmed.

HABITAT AND RANGE
Woodland and savanna from West Africa to Uganda.
EAST AFRICAN RECORDS
UGANDA BM : Tororo, (one ♂).

PEMBA ONEILI Clark 1925.
Proc. New Engl. zool. Cl. **19:** 32 (Rhodesia).
Known from Rhodesia only.

DOVANIA R. & J. 1903

Novit. zool. **9** *suppl.* : 44; type species *Dovania poecila* R. & J. 1903.
Antennae slender, hooked. Proboscis long. Eyes lashed. Tarsi spinose, tibiae spineless. Tibial spurs long. Pulvilli absent, paronychium with a single lobe on each side. Modified scales absent. Venation as in *Pemba.*

DOVANIA POECILA R. & J. 1903. (IV; 10)
Novit. zool. **9** *suppl.* : 47 (Dowa, Malawi, ♂).

♂: fw. 30–35 mm. Head and body blackish, woolly, with a series of white transverse bands interrupted at dorsum on abdomen. Fw very dark purplish brown, with faint, irregular paler transverse bands, a small white stigma, and two prominent white lines at apex. Hw bright coppery, blackish near inner margin.
GENITALIA: uncus entire, downcurved, slender, very heavily sclerotised apically. Gnathos blunt, prominent, very heavily sclerotised. Saccus short and slender. Valve narrow, subrectangular. Harpe ventral, very broad, apically truncated and spinose. Aedeagus bent downwsrds at $\frac{1}{4}$ from apex. Apex armed with a flat triangular projection.
FEMALE AND EARLY STAGES: unknown.

HABITAT AND RANGE
Forest, usually above 4,000 ft. in Kenya, Uganda, Ruanda, Burundi, Tanzania and Malawi.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega, Thomson's Falls.
	S :	Istsare.
	BM :	Elgon.
UGANDA	NM :	Fort Portal, Kalinzu, Kayonza, Nsongezi, Budongo.
	BM :	Entebbe, Jinja, Sesse Islands.
	B :	Mpanga, Nakawa.
	K :	Rwasamaire (Ankole), Kampala, Kakumiro, Kawanda.

TANZANIA NM : Mufindi.
BM : Njombe, Arusha.
R : Mbeya.

NOTE: ssp. *inops* Gehlen 1951 *Rev. Zool. Bot. Afr.* **44:** 251 based on a single ♂ from Ruanda is of doubtful validity.

DOVANIA NEUMANNI Jordan 1916. (IV; 11)
Novit. zool. **23:** 379 (Jimma, ♂).

♂: similar to previous species, but smaller; 24–26 mm. Antennae thicker, hw olive brown, pale abdominal bands much less conspicuous.
GENITALIA: very similar to *D. poecila*, but harpe less prominent, rounded apically and aedeagus only slightly curved with smaller triangular plate at apex.
FEMALE AND EARLY STAGES: unknown.

HABITAT AND RANGE
Forests in Ethiopia.
EAST AFRICAN RECORDS
ETHIOPIA NM : Adola.
BM : Addis Ababa, Arussi, Dangila, Jimma.

LOMOCYMA R. & J. 1903

Novit. zool. **9** *suppl.* : 47; type species *Sphinx oegrapha* Mabille, 1884.

LOMOCYMA OEGRAPHA (Mabille) 1884.
Sphinx oegrapha Mabille *C. R. Soc. ent. Belg.* **28:** 187 (Madagascar) Madagascar only.

OLIGOGRAPHA R. & J. 1903

Novit. zool. **9** *suppl.* : 48; type species *Sphinx juniperi* Boisduval 1847.

OLIGOGRAPHA JUNIPERI (Boisduval) 1847.
Sphinx juniperi Boisduval in Deleg. *Voy. Afr. Australe* **2:** 595 (Natal).
Coastal areas from the Cape to Natal.

OLIGOGRAPHA MOSAMBIQUENSIS Joicey & Kaye 1917.
Ann. Mag. nat. Hist. **20:** 305 (Delagoa Bay, Mozambique).
Known from the type locality only.

HOPLISTOPUS R. & J. 1903

Novit. zool. **9** *suppl.* : 49; type species *Hoplistopus penricei* R. & J. 1903.

HOPLISTOPUS PENRICEI R. & J. 1903.
Novit. zool. **9** *suppl.* : 50; (Munyendi River, Angola, ♂).
Known from the Kalahari, South-west Africa and Angola.

HOPLISTOPUS BUTTI R. & J. 1903.
Novit. zool. **9** *suppl.* : 50 (Beaufort West, Cape, ♂).
Cape Province, South Africa.

LITOSPHINGIA Jordan 1920

Novit. zool. **27**: 510; type species *Litosphingia corticea* Jordan 1920.
Antennae fairly thick and hooked. Proboscis rather short. Third joint of palpus very small, conical, 2 strong lateral spines on foretibiae. Mid and hindtibiae spineless. Tibial spurs moderate. Tarsi spinose. Pulvillus present, paronychium with one long lobe at each side. Veins 6 and 7 of hw not stalked.

LITOSPHINGIA CORTICEA Jordan 1920. (IV; 16)
Novit. zool. **27**: 510 (Rhodesia).

A small grey species, rather like a miniature edition of *Pemba favillacea* Walker.
♂: fw. 22 mm. Both wings long and narrow, apices acute, as in *P. favillacea*. Body grey with a dark dorsal line. Wings grey with veins darker.
GENITALIA: uncus downcurved, constricted at base, apically spatulate and slightly bilobed. Gnathos much broader than uncus, with a broad, subquadrate median projection. Saccus fairly long and broad. Dorso-basal margin of valve reflexed, forming a fold which is covered with spines and armed with numerous stout hooks at the margin. Dorso-apical margin of valve not reflexed, but spinose. Harpe ventral, terminating in a very stout, heavily sclerotised hook. Aedeagus short and straight, folded back apically.

♀: similar to ♂, but larger, darker, wings more rounded (fw 27 mm.).
GENITALIA: vaginal plate lightly sclerotised, with several parallel longitudinal folds on either side of ostium. Ductus membranous, short, strongly kinked near ostium. Bursa small, ovoid rugose. Signa absent. Struts long.
EARLY STAGES: unknown.

HABITAT AND RANGE
Savanna and bush from Matabeleland to Tanzania.
EAST AFRICAN RECORDS
TANZANIA NM : Dar es Salaam.

PRAEDORA R. & J. 1903

Novit. zool. **9** *suppl.* : 50; type species *Praedora marshalli* R. & J. 1903.

Proboscis about half the length of body. Antennae fairly slender, hooked. Midtibiae spinose; foretibiae spinose, with a very strong, long terminal spine. Spurs spinose. Pulvillus present, paronychium with one lobe on each side. Similar in appearance to *Poliana micra* R. & J.; for distinguishing characters see that species. Vein 6 of both wings not stalked.

PRAEDORA MARSHALLI R. & J. 1903.
Novit. zool. **9** *suppl.* : 51; (Umtali, Rhodesia, ♂).

Ssp. *marshalli*.
Savanna and bush in N. Transvaal, Rhodesia, Zambia and Angola.

Ssp. *tropicalis* R. & J. 1912. (IV; 15)
Novit. zool. **19:** 128 (Uganda).

Darker and larger than typical *P. marshalli*, probably a cline.
Sexes superficially identical. Fw. 19–24 mm. Body and fw very dark grey, fw with paler irregular transverse bands and darker transverse crenulate lines. Hw paler, with traces of 2 faint transferse dark bands. Wings more rounded than in *Litosphingia*.
♂ GENITALIA: uncus strongly downcurved, laterally compressed very strongly sclerotised, and slightly hooked apically. Gnathos well sclerotised, apically rounded. Saccus fairly slender. Valve with numerous small spines, particularly in upper half and at dorso-basal margin, which is somewhat incrassate. Harpe ventral, terminating in a rounded upcurved lobe. Aedeagus short, straight, unarmed, tapering towards apex.

♀ GENITALIA: vaginal plate a truncated triangle. Ostium with a narrowly sclerotised anterior lip. Ductus wide, membranous, very long, without kinks, Bursa membranous, pear-shaped, without signum. Struts long.
EARLY STAGES: unknown.

RANGE AND HABITAT
Savanna and bush from Zambia to Uganda and Kenya.
EAST AFRICAN RECORDS

UGANDA	NM :	Budongo, Nsongesi.
	BM :	Ankole.
TANZANIA	NM :	Nachingwea, Arusha, Mbeya, Shango, Ndolage, Kigoma.
	R :	Dar es Salaam.
KENYA	NM :	Msambweni (coast).

PRAEDORA PLAGIATA R. & J. 1903. (IV; 14)
Novit. zool. **9** *suppl.* :51 (M'pala, Tanganyika ♀).

Very similar to previous species, but larger, more variegated and heavily marked. Sexes superficially identical. Fw. 24–29 mm.
♂ GENITALIA: uncus very short, laterally compressed, downcurved, heavily sclerotised apically. Gnathos as in *P. marshalli*. Saccus short, subtriangular. Membranous, apical half of valve square, densely spinose internally. Harpe ventral, terminating in a broad downcurved, apically dentate process. Aedeagus extremely short and thick.

♀ GENITALIA: vaginal plate broad, strongly rugose. Ostium wide; ductus short, wide, membranous, without kinks. Bursa pear-shaped, rugose. Signum large, lanceolate, spinose, with membranous centre, rather like a strongly compressed ring.
EARLY STAGES: unknown.

HABITAT AND RANGE
Savanna from Rhodesia to Tanzania.
EAST AFRICAN RECORDS

TANZANIA	NM :	Mukuyu.
	BM :	Pigawazi.
	R :	Ilonga.
ZAMBIA	NM :	Abercorn.

PRAEDORA LEUCOPHAEA R. & J. 1903. (IV; 8)
Novit. zool. **9** *suppl.* : 52 (Ikutha, British East Africa, ♂).

♂: fw. 20–21 mm. Body and fw greyish white with light brown transverse bands. Hw uniform very pale grey.
GENITALIA: uncus longer, not so compressed as in previous species. Gnathos subquadrate, apically rounded. Saccus slender. Valve elongated, apically rounded, hairy and tuberculate, not spinose, with a small emargination at the ventral margin. Harpe ventral, small, terminating in a minutely spinose upcurved rounded lobe. Aedeagus long, stout and straight.
FEMALE: unknown.

HABITAT AND RANGE
Dry bush areas from Natal and Bechuanaland to Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kurdi.
	BM :	Ikutha (type).

ELLENBECKIA R. & J. 1903

Novit. zool. **9** *suppl.* : 809; type species *Ellenbeckia monospila* R. & J. 1903.
Proboscis vestigial, reduced to 2 short lobes covered with scales. Palpi very small. Foretibiae armed with a few long external spines. Tarsi spinose. Mid and hindtibiae without spines. Tibial spurs short. Antennae hooked. Pulvillus and paronychium absent. Vein 6 of fw free, veins 6 and 7 of hw stalked.

ELLENBECKIA MONOSPILA R. & J. 1903. (X; 7,9—XIII; 7)
Novit. zool. **9** *suppl.* : 810 (Fader Gumbi, ♀).

♀: fw. 21 mm. Body and wings grey. Fw, with veins finely delineated in black, a small blackish stigma, and a paler marginal band. A large blackish grey rounded spot, outlined in pale grey near tornus. Hw uniform grey.
GENITALIA: vaginal plate narrow, posteriorly indentated, with a deep sinus at each side of ostium anteriorly. Ostium wide, narrowing rapidly to ductus. Ductus membranous, with a constriction before bursa. Bursa very long, only slightly saccate apically, smooth. Signum absent. Posterior struts long and flattened, anterior struts short and flattened.
EARLY STAGES: unknown.

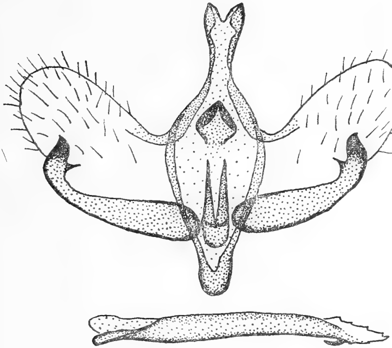
HABITAT AND RANGE
Arid areas of Kenya and Somalia.
EAST AFRICAN RECORDS

KENYA	NM :	Mtito Andei, Mandera, Wajir.
	BM :	Merti, Dandu.
SOMALIA	BM :	(Type) Fader Gumbi.

♂ (previously undescribed): differs in its smaller size (fw. 19 mm.), in having a better defined black stigma and tornal spot and a white hw.
GENITALIA: uncus short, downcurved, broadly spatulate, terminating in two widely diverging blunt points. Gnathos a short, broad, heavily sclerotised pointed plate; anellus a long sleeve strongly produced anteriorly, with two sharply pointed heavily sclerotised posterior processes. Saccus very broad at base, tapering sharply towards apex which is upcurved, dorso-ventrally compressed. Valve rather long and narrow, apically rounded. Harpe ventro-basal, very broad at base, terminating in a very heavily sclerotised upcurved blade with a sharp point directed posterad at middle of ventral margin of

valve. Adeagus fairly long and slender, slightly sinuous, with a short downcurved basal lobe; apex unarmed, except for a small reflexed subapical hook on right side. Vesica unarmed.

NEALLOTYPE ♂: Kenya, North-Eastern Region, Wajir, XII-1967, J. H. M. Adam, in National Museum Nairobi.



Ellenbeckia monospila R. & J.,♂ genitalia

Subfamily SEMANOPHORINAE

Tribe DILOPHONOTINI

Subtribe AELLOPODES

CEPHONODES Hubner 1822

Verz. bek. Schmett: 31; type species *Sphinx hylas* Linnaeus, 1771.
1865 *Potidea* Wallengren *Kongl. Sv. Vet. Ak. Handl.* (2) **4**: 17; type species *Potidea virescens* Wallengren, 1865.

Heavy bodied, medium sized diurnal insects. Antennae very heavily clubbed and hooked in both sexes. Palpi pointed, laterally angular, inner surface well scaled. Posterior margins of abdominal tergites armed with stout, broad, flat spines. Anal end truncated, decorated with tufts of long hair-like

scales which are expanded into a fan when the insect is in flight. Merum of mid and hindcoxa with strong angular projection. Internal surface of tarsi spinose. Tibiae without spines, tibial spurs normal. Wings covered with deciduous hair-like scales at emergence, most of which are soon lost, leaving the hyaline wing membrane exposed. Wing margins regular. Discoidal cell of fw narrow, less than $\frac{1}{2}$ of length of costa; radius arises near base of cell; veins 6, 7, 8, and 9 on a common stalk arising well before end of cell, 8 and 9 anastomosed at apex. Hw cell exceedingly short, $\frac{1}{5}$ of length of wing from base to end of vein 5; veins 3 and 4 on a long stalk; 6 and 7 also on a long stalk. Genitalia of males without modified scales, strongly asymmetrical. All the species are generalised mimics of *Xylocopa* bees.

There are 13 species, 8 of which are Indo-Australian, 1 Afro-Oriental and 4 from Madagascar and the Islands.

CEPHONODES HYLAS (L) 1771.
Sphinx hylas L. *Mant. Plant.* : 539 (China).
Ethiopian and Indo-Australian Region.

Ssp. *hylas.*
India and Ceylon to China and Japan.

Ssp. *cunninghami* (Walker) 1856.
Sesia cunnighami Walker *List. Lep. Ins. B.M.* **8:** 85 (Australia). Northern Australia and Queensland to the island of Flores.

Ssp. *virescens* (Wallengren) 1865. **(V; 1—XVII; 1)**
Potidea virescens Wallengren *Kongl. Sv. Vet. Ak. Handl.* (2) **4:** 17 (Caffraria, South Africa).
1875 *Macroglossa confinis* Boisduval *Spec. Gen. Lep. Het.* **1:** 376 (Senegal).

Sexes identical. Fw. 25–30 mm. Antennae black; head and thorax bright olive green above, creamy white below. Upper surface of abdomen bright olive green at base; irregular dark red transverse band near middle, distal part greenish-yellow, anal fan black. Underside of abdomen dark red with some white at base and near apex. Fw mainly hyaline, black at costa and apex, olive green at base and inner margin. Hw mainly hyaline, but olive green at base, costa, inner margin and tornus.
♂ GENITALIA: highly asymmetrical. Right hand half of tegumen larger than left. Right lobe of uncus extremely reduced, left lobe a strong, slender sharply downcurved hook. Lobes of gnathos fused into a single process sharply pointed to the left. Saccus very broad and rounded, the left side better developed. Right valve larger than left, narrower at base, with regularly curved apex; ventral and outer margins hairy. Left valve much smaller, with outer margin concave and hairy, produced into a rounded, dorso-apical lobe covered in short spines. Aedeagus extremely slender and long, whip-like, unarmed. Cornuti absent.

♀ GENITALIA: 8th tergite very broad, posterior margin armed with a fringe of broad flat spines. Ostium leading into a very broad rounded chamber with two pointed lateral projections ending in the anterior struts. 8th sternite narrowly and irregularly sclerotised laterally, produced into a broad central post-vaginal plate. Posterior portion of ductus sclerotised, very narrow and short; anterior portion constricted, very short and membranous; bursa elongated, smooth and membranous, without signa. 7th sternite trapezoidal, with posterior margin armed with a fringe of broad flat spines. Posterior struts long, apically dilated.

RANGE AND HABITAT
Very common throughout the Ethiopian Region including Madagascar and the Seychelles. Inhabits

most habitats with the exception of extreme deserts and may often be seen feeding at flowers in full sunlight.

EAST AFRICAN RECORDS

KENYA	NM :	Nakuru, Nairobi, Makueni, Isiolo, Aberdares.
	SM :	Istsare, Kitale, Shimo la Tewa.
	S :	Mombasa.
UGANDA	NM :	Kampala.
	B :	Nakawa.
	L :	Mweya.
TANZANIA	NM :	Amani, Ukerewe, Mtwara.
	R :	Dar es Salaam, Ukiriguru.
	MC :	Lindi, Songea.
	SM :	Saza.
ETHIOPIA	NM :	Dire Dawa, Koka.

CEPHONODES APUS (Boisduval) 1833.
Macroglossa apus Boisduval *Faune Mad. & Bourb. :* 79 (Islands of Bourbon and Mauritius.)

CEPHONODES TROCHILUS (Guérin) 1843.
Macroglossum trochilus Guérin, in Deless., *Voy. Ind. Or. :* 81 (Mauritius).
1844 *Macroglossum cynniris* Guérin *Ic. Regne Anim.* **2:** 495 (Mauritius).
Known from Mauritius only.

CEPHONODES LEUCOGASTER R. & J. 1903.
Novit. zool. **9** *suppl. :* 469 (Antanambe, Madagascar, ♂).
Known from Madagascar only.

CEPHONODES TAMSI Griveaud 1960.
Bull. Soc. ent. France **65:** 44 (Mahé).
Known from the Seychelles only and possibly extinct.

Tribe PHILAMPELINI

Subtribe NEPHELES

SPHINGONAEPIOPSIS Wallengren 1858

Oefv. Vet. Ak. Forh. **15:** 138; type species *S. gracilipes* Wallengren 1860.
Pterogon nanum Boisduval 1847.

Very small species. Antennae fasciculate in the males, with last segment very short. Palpi fully scaled internally, 1st segment with an external fan of long scales which is held across the eye. Eyes ciliated; vertex crested. Tibiae spinose; tarsi spinose, very long and slender. Spines of abdominal tergites very weak. Termen of both wings dentate, somewhat irregular. Discoidal cell of both wings long, broad, abruptly truncated. Veins 6 and 7 of hw with a common origin, but not stalked. Male genitalia without modified scales, female genitalia with signa. The ♂ armature of the type species is similar to some of

the simpler armatures found in the Asemanophorinae, whereas the armature of the other species is typically Philampeline. The female genitalia are very consistent in all the species examined.
There are 7 known species, 2 of which are Palaearctic, 1 Oriental and 4 Ethiopian.

SPHINGONAEPIOPSIS NANA (Boisduval) 1847. (V; 3—XIII; 8—XIV; 8)
Pterogon nanum Boisduval in Deleg. *Voy. Afr. Austr.* : 594 (Zululand).
1860 *Sphingonaepiopsis gracilipes* Wallengren *Wien. ent. Mon.* **4:** 42 (Caffraria).

♂: fw. 11–13 mm. Head and body pale pinkish brown to greyish brown. Fw pale pinkish brown to greyish brown with a large darker triangular spot at costa $\frac{2}{3}$ from base, and a similar rectangular spot near middle of inner margin. A very small dark spot at inner margin before tornus. Hw uniformly brown.

♀: similar to ♂, but slightly larger (fw. 12–14 mm.); antennae much more slender.
GENITALIA: 8th tergite simple, showing a broad sculptured posterior band (sockets of spines). Inner surface of ostium produced into a pointed post-vaginal plate and 2 regular, blunt lateral plates; ante-vaginal area rounded, membranous. Colliculum narrow, tapering, directed to the left side. Ductus short; bursa rugose, elongated. Signum a very long undivided longitudinal rod armed with minute teeth. Posterior struts long and slender.

EARLY STAGES: (after D. G. Sevastopulo).
LARVA, penultimate instar: head small, dull orange brown. Body blackish brown; a black dorsal line and a subdorsal stripe, orange brown on the 2nd somite and on the anterior half of the 3rd thereafter composed of minute white dots. 3rd and 4th somites each with a transverse series of six white dots; the abdominal somites each with two subdorsal white dots, the anterior slightly nearer the subdorsal line than the posterior. Legs orange, venter and proleges blackish brown, feet orange. Anal flap with an orange lateral stripe. Horn long, straight and erect, black with an orange basal line on each side, freely movable along axis of body.
FINAL INSTAR: very similar to above; subdorsal stripe extending to 3rd somite, white dots tinged with orange. Traces of a dull orange brown sublateral stripe, speckled with white. Spiracles orange. Horn laterally compressed, slightly constricted at base, apically blunt.

PUPA: in a loose cocoon of brown silk among litter on the surface of the soil. Yellowish olive with intersegmental sutures black on thorax, brown on abdomen. Abdomen decorated with a dark green dorsal stripe and transverse lines of small black dots. Wing cases with black lines from base to just before termen, interrupted in the discoidal cell. Eye, proboscis, antennae and legs outlined in black. Apex of abdomen black, cremaster a stout black spike.
The excreta of the larva, instead of being voided in short pellets, form "sticks" from 1 to 4 cm. in length.
FOOD PLANTS: fam. Rubiaceae.

HABITAT AND RANGE
A crepuscular species, frequently seen on flowers. Open habitats from South Africa to East Africa and Arabia in the east and to Angola and Nigeria in the west.
EAST AFRICAN RECORDS

KENYA	NM :	Kitale, Nakuru, Mtwapa, Mombasa.
	BM :	Kericho, Rabai, Suna.
	ESB :	Muguga.
UGANDA	SM :	Bombo.
	BM :	Entebbe, Bujungu, Jinja.

TANZANIA	NM	:	Ukerewe, Dodoma, Kurasini, Amani.
	BM	:	Pemba, Dar es Salaam.
	R	:	Ilonga, Mlingano, Ukiriguru.
	MC	:	Lindi, Songea.

SPHINONGONAEPIOPSIS ANSORGEI Rothschild 1904. (V; 2—XIII; 9—XIV; 14)
Novit. zool. **11:** 438 (Mikenge, Angola, ♂).
1928 *Sphingonaepiopsis ansorgei featheri* Clark *Proc. New Engl. zool. Cl.* **10:** 45 (Elgon, Kenya) syn. nov.

♂: fw. 14–15 mm. Antennae thicker than in *S. nana*. Groundcolour of body and fw more reddish. Dark spots absent, but replaced by a broad, rather diffuse diagonal band. Hw uniform, more reddish. GENITALIA: uncus laterally compressed, sharply pointed, heavily sclerotised at apex. Gnathos almost as long, heavily sclerotised and armed with a few blunt teeth pointing upwards near apex. Saccus broad and rounded. Valve long and pointed with a slight ridge parallel to dorsal margin. Harpe ventral, short, broad and rounded. Aedeagus stout, not tapered, apically armed with a broad, reflexed plate, rather like a shepherd's crook. Vesica unarmed.

♀: very similar to *S. nana*, but postvaginal plate like a broad inverted V. Ostium rounded, but less enlarged than in *S. nana*. Colliculum shorter and wider, not directed to one side. Ductus much wider. Bursa elongated, smooth. Signum near apex of bursa, short, pear-shaped, with the sharp end directed backwards and bifid, and covered by larger teeth than in *S. nana*.

HABITAT AND RANGE

Open habitats from Natal to East Africa in the east and to Angola in the west.

EAST AFRICAN RECORDS

KENYA	NM	:	Kitale.
	SM	:	Istsare.
	S	:	Mombasa.
	BM	:	Rabai.
TANZANIA	BM	:	Upper Ruvubu River, Urindi.
	NM	:	Tabora.
ZAMBIA	NM	:	Abercorn.

SPHINGONAEPIOPSIS OBSCURA (Mabille) 1880.
Pterogon obscurus Mabille *Ann. Soc. ent. France* (5) **9:** 344 Madagascar only.

SPHINGONAEPIOPSIS WELLSI Griveaud 1959.
Faune Madag. **8:** 109 (♀).
Madagascar only.

ODONTOSIDA R. & J. 1903

Novit. zool. **9** *suppl.* : 586; type species *Smerinthus pusillus* Felder 1874.

ODONTOSIDA PUSILLA (Felder) 1874.
Smerinthus pusillus Felder *Reise Novara, Lep.* t. 82 f.1 (Caffraria, Tsomo River).
1894 *Lophuron pulcherrimum* Rothschild *Novit. zool.* **1:** 70 (Namaqualand).
Cape, Natal and Transvaal.

ODONTOSIDA MAGNIFICA (Rothschild) 1894.
Lophuron magnificum Rothschild *Novit. zool.* **1:** 71 (Namaqualand).
Cape, Natal and Rhodesia.

Odontosida erlangeri R. & J. See *Rufoclanis erlangeri* (R. & J.).

MICROSPHINX R. & J. 1903

Novit. zool. **9** *suppl. :* 593; type species *Pterogon pumilum* Boisduval 1847.

MICROSPHINX PUMILA (Boisduval) 1847.
Pterogon pumilum Boisduval in Deleg. *Voy. Afr. Austr. :* 594 (Zululand).
1897 *Lophuron minutum* Distant *Ann. Mag. nat. Hist.* (7) **19:** 580 (Pretoria).
South Africa only.

The above three genera are rather different from the rest of the Philampelini and have some characters in common with the Ambulicini; their true systematic position is uncertain.

MACROGLOSSUM Scopoli 1777

Intr. Hist. Nat. : 414; type species *Sphinx stellatarum* Linnaeus 1758.
1822 *Psithyros* Hübner *Verz. bek. Schmett. :* 131; type species *Spninx stellatarum* L. 1758, Europe.
1858 *Rhamphoschisma* Wallengren *Oefv. Vet. Ak. Forh.* **15:** 139; type species *Psithyros trochilus* Hübner 1824, Africa.

A large genus of small to medium sized, heavy-bodied diurnal species.
Very similar to *Cephonodes*, but differs mainly in the structure of the ♂ genitalia, which are symmitrical.
Proboscis long. Eye ciliated. Palpus projecting beyond frons, laterally angular, inner surface fully scaled. Vertex slightly crested. Antennae strongly clubbed. Spines on abdominal tergites as in *Cephonodes*. 7th sternite spineless, triangular in ♀. Anal fan of long hair-scales as in *Cehponodes*, preceded by lateral tufts on the more proximal segments. Merum of midcoxa produced backwards into a sharp tooth. Tibiae spineless, except on shorter midtibial spur, which has a prominent comb of spines. Hindtibial spurs very unequal. Tarsi spinose. Paronychia and pulvilli normal. Wing margins regular. Venation of fw as in *Cephonodes*, but veins 8 and 9 not anastomosed at apex. Hw cell longer and broader than in *Cephonodes;* veins 3 and 4 arise very close to one another, 6 and 7 with a common origin, but not stalked. Male genitalia without modified scales. The sexes are very similar and cannot be separated unless dissected, except by the presence of a retinaculum in the males.
Larva tapering forwards to a small head. Pupa with compressed, ventrally carinate proboscis sheath.
1 Palaearctic species, 1 African, 5 from Madagascar and the Islands and 52 Oriental species.

MACROGLOSSUM TROCHILUS (Hübner) 1824.
Psithyros trochilus Hübner *Samml. Ex. Schmett.* **2:** 158 (Africa).
Ssp. *trochilus*. (V; 4)
1856 *Macroglossa sitiene* Walker *List. Lep. Ins. B.M.* **8:** 92 (Natal).
1858 *Rhamphoschisma fasciatum* Wallengren *Oefv. Vet. Ak. Handl.* **15:** 139.

Sexes identical. Fw. 15–18 mm. Antennae blackish. Head and thorax pale olive above, very pale buff below. Abdomen pale olive above, orange laterally. Posterior segments darker dorsally, with a yellow

distal fringe. Anal fan very dark brown, tipped with buff. Small lateral tufts dark brown and white. Abdomen reddish brown below. Fw brown with a series of darker transverse bands. Hw orange with a very broad dark reddish brown border. Both wings brownish red below.

♀ GENITALIA: postvaginal plate very small, triangular. Ostium broad and rounded. Colliculum short and wide. Ductus very wide, with an elbowed expansion near base. Bursa ribbed, pear-shaped. Signum a long longitudinal spiny plate pointed at both ends and with a narrow median ridge.

HABITAT AND RANGE

Frequently seen at flowers in full sunshine. Very common in most habitats throughout southern and eastern Africa and in the Comoro Islands.

EAST AFRICAN RECORDS

KENYA	NM :	Chyulu Hills, Kapenguria, Nairobi, Thomson's Falls, Elgon, Nakuru.
	SM :	Istsare, Kitale, Malindi.
	S :	Kaptagat, Shimba Hills, Mombasa.
UGANDA	NM :	Kamengo, Mafuga (Kigezi).
	SM :	Bombo.
	B :	Kampala.
TANZANIA	NM :	Ngorongoro, Kilimanjaro.
	MC :	Lindi, Songea.

Ssp. *trochiloides* (Butler) 1875.
Macroglossa trochiloides Butler *Proc. zool. Soc. Lond.* : 5 (Sierra Leone).
Sierra Leone to Angola and the upper Congo.

MACROGLOSSUM ALLUAUDI (Joannis) 1893.
Macroglossa alluaudi Joannis *Bull. Soc. ent. France.* : 52.
Seychelles only, probably extinct.

MACROGLOSSUM SOROR R. & J. 1903.
Novit. zool. **9** *suppl.* : 639 (Isle de France, Bourbon, ♀). Bourbon only.

MACROGLOSSUM MILVUS (Boisduval) 1833.
Macroglossa milvus, Boisduval *Faune Mad. Bourb.* : 78 (Bourbon).
1844 *Macroglossa pandora* Guérin *Icon. Regne Anim.* **2:** 495 Bourbon and Mauritius.

MACROGLOSSUM AESALON (Mabille) 1879.
Macroglossa aesalon Mabille *Ann. Soc. ent. France.* : 299 (South-east Madagascar).
Madagascar, Mauritius and Comoro Islands.

MACROGOLOSSUM PACHYCERUS R. & J. 1903.
Novit. zool. **9** *suppl.* : 630 (Tamatave, Madagascar, ♂). Madagascar only.

LEUCOSTROPHUS R. & J. 1903

Novit. zool. **9** *suppl.* : 671; type species *Macroglossa commasiae* Walker 1856.
Differs from *Macroglossum* in the terminal segment of the antenna being short, in vein 5 of fw arising

below middle of discoidal cell and in veins 3 and 4 being stalked. Tarsi and tibial spurs shorter than in *Macroglossum*. Male genitalia without modified scales.
Two African species, both diurnal and very similar to *Macroglossum* in appearance and behaviour.

LEUCOSTROPHUS COMMASIAE (Walker) 1856.
Macroglossa commasiae Walker *List. Lep. Ins. B.M.* **8:** 90 (Sierra Leone).
West Africa to Gabon and to Kasai (s-w Congo).

LEUCOSTROPHUS HIRUNDO (Gerstaecker) 1871. (V; 5—XIV; 3—XV; 12)
Macroglossa hirundo Gerstaecker *Arch. Naturgesch.* **37:** 360 (Mombasa).

Sexes identical. Fw. 16–20 mm. Antennae blackish. Head, thorax and base of abdomen dark grey. Fw dark grey with darker transverse lines and bands. A prominent dark spot near apex. Hw uniform dark grey. A conspicuous irregular white band across abdomen. Anal fan black, lateral tufts black and white.

♀ GENITALIA: very similar to *Macroglossum trochilus*, but colliculum shorter, ductus much narrower and longer, signum shorter.

HABITAT AND RANGE
Feeds on flowers in full sunlight. Very common in most habitats throughout southern and eastern Africa.

EAST AFRICAN RECORDS

KENYA	NM	:	Nairobi, Embu, Nyeri, Nakuru.
	S	:	Mombasa.
TANZANIA	NM	:	Kilimanjaro, Amani.
	R	:	Dar es Salaam, Ilonga, Mbeya, Mlingano.
ETHIOPIA	NM	:	Dire Dawa.
	GM	:	Afgoi.

ATEMNORA R. & J. 1903

Novit. zool. **9** *suppl.* : 615; type species *Macroglossa westermanni* Boisduval 1875.
A single species from Africa, linking *Macroglossum* and allied genera to *Temnora*. Crespuscular and nocturnal. Palpi projecting beyond frons, laterally angular, densely scaled internally. Antennae more slender than in two previous genera, with short bundles of cilia in the ♂, sharply hooked, apical segment long. Process at base of proboscis (pilifer) very large. Eyes not ciliated. Abdominal spines large and numerous. Anal fan much narrower than in previous genera; lateral tufts very much smaller. Merum of midcoxa with angular process. Tibiae unarmed, tarsi densely spinose. Tibial spurs normal. Wing margins regular, entire. Vein 5 of fw arises from middle of discoidal cell, 3 and 4 have separate origins. Hw cell very narrow, short; veins 3 and 4, and 5 and 6 with common origins, but not stalked. Male genitalia with large, deciduous modified scales, as in succeeding genera.

ATEMNORA WESTERMANNI (Boisduval) 1875. (V; 6)
Macroglossa westermanni Boisduval *Spec. Gen. Lep. Het.* **1:** 355 (Guinea).
1879 *Macroglossa falkensteini* Dewitz *Mitt. munch. ent. Ver.* **3:** 23 (Chinchoxo, Angola).

♂: fw. 23–27 mm. Antennae blackish. Head and thorax dark olive, brighter in fresh specimens, with a dark dorsal line. Abdomen mainly dark orange brown dorsally, bright orange at base and laterally.

Anal tuft very dark orange brown, tipped with pale buff. Basal third of fw dark olive, fading to dark orange brown in old specimens. Remainder of fw violet-brown with two irregular, rather diffuse dark brown bands well separated at the costa, but meeting before tornus, the inner much more curved than the outer. Antemedial straight, perpendicular to axis of wing, separating olive basal area from paler distal area. Two faint, narrow dark wavy oblique lines from inner margin to inner dark band. Cilia dark brown. Hw uniform slightly olivaceous very dark brown, with pale orange cilia and inner margin.

♀: similar to ♂, but antennae more slender, anal fan much narrower. Fw 29–31 mm.
GENITALIA: bursa elongated, ribbed and minutely pitted. A small transverse spiny signum near base and a very small rounded signum near apex, surrounded by an area of thickened membrane.

EARLY STAGES: (after D. G. Sevastopulo).
MATURE LARVA: thoracic segments tapering sharply to a small round green head. Body rather stout, green; a fine blue-black dorsal line entire on somites 2 to 4, interrupted at the rear of each somite, from 5 to 11. Dorsal area sprinkled with white dots which form rough oblique dorso-lateral stripes, the one on 7–8 terminating laterally in four large creamy white dots. A dark olive green oblique stripe edged below with whitish green from the subdorsal area of the 10th somite to the base of the horn. Horn stout, downcurved, dull slate blue, with 2 large cream lateral spots at base. Spiracles very dark blue. Legs pink, venter and prolegs green.

PUPA: in a leaf with edges spun together on the surface of the soil. Pinkish minutely speckled with black and with very fine rufous streaks radiating from rufous specks. A faint greyish dorsal line and a subdorsal series of greyish dots. A series of lateral subtriangular olive suffusions on abdomen. Venter suffused with olive, with a reddish median line becoming black from 7th abdominal sternite to base of cremaster. Wing cases, leg and antenna sheaths very pale pinkish olive with fine irregular olive streaks giving the appearance of a dead leaf, the costal margin dark brown and producing the illusion of a mid-rib. The outer margin of the wing case with a whitish submarginal and a red-brown marginal line. Head with a dorsal, roughly pear-shaped dark chocolate mark edged with whitish, the dorsal line originating from the tip of this spot.
Pupa with eyes angulate, broad across the 3rd abdominal somite, tapering rapidly after the 8th. Cremaster narrowly spade-shaped, with a few apical hooked spines which are fixed in the silk of the very slight cocoon.
FOOD PLANT: *Strychnos* sp. (Loganiaceae), according to Pinhey, 1962.

HABITAT AND RANGE
Wooded habitats throughout the Ethiopian Region including Madagascar, but excluding the extreme south of the continent.
EAST AFRICAN RECORDS

KENYA	NM :	Aberdares, Kiganjo, Nakuru.
	SM :	Kisumu, Kakamega.
	S :	Mombasa.
	BM :	Nairobi, Kibwezi, Hoey's Bridge.
UGANDA	NM :	Kayonza, Kamengo, Budongo.
	SM :	Ruwenzori, Kalinzu.
	BM :	Kampala, Entebbe, Jinja, Katera.
	L :	Mweya.
	ESB :	Kidepo.
TANZANIA	NM :	Ukerewe, Amani.
	SM :	Mwanza.
	R :	Ilonga, Mlingano, Tabora, Ukiriguru.
	BM :	Pemba.

ANTINEPHELE Holland 1889

Trans. Amer. ent. Soc. **16:** 68; type species *Nephele anomala* Butler 1882.

Palpi short, laterally rounded, with a small bare patch on inner surface. Eye ciliated. Antennae long, very slender, more so in ♀; apical hook gradual and long. Abdomen broad and flattened. Abdominal spines long and weak, anal tuft long and narrow. Merum of hindcoxa without keel. Tibiae unarmed, hindtibial spurs very unequal. Mid and hindcoxa with comb of long spines. Wing margins entire, or slightly dentate. Venation of fw as in *Atemnora.* Hw cell narrower and longer, sharply angled distad at origin of vein 4; veins 6 and 7 on a common stalk. Male genitalia of the same pattern as in the following genera, with a few large modified scales. Cornuti of vesica well developed. Females with large signa. Medium sized crepuscular insects seldom attracted to light. More than half the specimens taken at flowers are females. The sexes are identical and can only be separated by the presence of a retinaculum in the males, and by the antennae.

ANTINEPHELE ANOMALA (Butler) 1882.
Nephele anomala Butler *Ann. Mag. nat. Hist.* (5) **10:** 434 (Aburi, Gold Coast, ♂).

Ssp. *anomala.*
Sierra Leone to Nigeria.

Ssp. *camerunensis* Clark 1937. (V, 8)
Proc. New Engl. zool. Cl. **16:** 34 (Cameroon).

Sexes identical. fw 18-21 mm. Head and thorax slightly ochreous brown to chocolate-brown with a narrow pale green dorsal line. Abdomen darker brown. Fw ochreous brown to chocolate. A pale green line from inner margin near base to costa before apex. A broader, straight green line from tornus to costa, edged proximally with white and distally with blackish. A fine zigzag white line at apex. Hw uniform dark brown.

♀ GENITALIA: vaginal plate subtriangular with a large reniform central opening for ostium. Colliculum fairly long and narrow. Ductus short. Bursa small, rounded smooth. A large heart-shaped signum with few large tubercles near base, apex directed towards apex of bursa. Signum followed distad by a leaf-shaped area of thickened membrane covered in minute papillae and with a median depression where the membrane is thinner.

HABITAT AND RANGE
Forests from Cameroon to Uganda and W. Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kaimosi, Kakamega.
UGANDA	NM :	Nagunga, Entebbe, Kamengo.
	SM :	Budongo Forest.
	BM :	Mabira Forest, Kampala.
	K :	Kawanda.

ANTINEPHELE MARCIDA Holland 1893. (V; 9—XIV; 6,11)
Ent. News **4:** 340 (Benita, Gabon, ♂).

Sexes similar. Fw. 23–26 mm. Very similar to previous species. Groundcolour of fw and body paler, orange-brown, never chocolate. Green bands of fw darker, broader, outer band more oblique,

reaching apex nearer base. A dark terminal spot below apex surrounded by a small whitish apical area. Hw uniform dark brown.
♂ GENITALIA: uncus slender, subapically dilated, very much longer than gnathos. Valve upcurved, modified scales long and narrow, in 2 series. Harpe long, slender and straight. Saccus short and broad. Aedeagus apically unarmed. Vesica armed with a long narrow blade-like structure terminating in a sharp point and with a series of teeth along the distal half of one side.

♀ GENITALIA: similar to *A. anomala*, but anterior part of vaginal plate lacking. Colliculum shorter and wider. Bursa as in *A. anomala;* signum similar, but lobes less pronounced, apex less acute, thickened area better defined at margins, with median depression narrower, forming a groove.

HABITAT AND RANGE
Forests from the Cameroons to Uganda and West Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Budongo Forest, Kamengo, Entebbe.
	BM :	Kampala, Jinja.
	K :	Kawanda, Nagunga.

ANTINEPHELE ACHLORA Holland 1892. (V; 7)
Ent. New **4:** 340 (Benita, Gabon).

Sexes similar. Fw. 19–23 mm. Body and wings very dark brown. Fw. a pale band composed of 3 irregular more or less parallel narrow lines set close together, from inner margin near base to costa at $\frac{1}{3}$ from base; a small pale stigma, a broad pale band from costa at $\frac{2}{3}$ from base to tornus, and a narrower pale band from apex to middle of outer band; pale markings may be light green or pinkish in fresh specimens; when green they usually fade to pinkish with age. Hw uniform dark brown.

♀ GENITALIA: vaginal plate not clearly defined. Edges of ostium thickened and recurved. Colliculum directed to the left. Bursa slightly ribbed and pitted near base. Signum heart-shaped as in previous species, with elongated thickened area well defined, but irregular at the edges.
HABITAT AND RANGE
Forests from Sierra Leone to Uganda and west Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Kamengo, Nagunga, Kampala, Entebbe, Budongo Forest.
	BM :	Mpumu, Jinja.
	K :	Kawanda.

ANTINEPHELE LUNULATA R. & J. 1903. (V; 10)
Novit. zool. **9** *suppl.* : 598 (Mikindani, Tanganyika, ♂).
1926 *Antinephele weberi* Clark *Proc. New Engl. zool. Cl.* **9:** 53.

Sexes similar. Fw. 18–21 mm. Body and fw dull orange-clay coloured to dull ochreous olive. Fw with blunt apex and slight emargination below apex; variously mottled and lined with brown; an ill-defined paler area nearer apex, and a small prominent dark apical spot. Hw uniformly dark brown.

♀ GENITALIA: 8th tergite with a very broad, shallow mesial sinus at posterior margin. Vaginal plate consisting of a very narrow sclerotised transverse plate immediately behind dorsum. 8th sternite with one deep, long oblique cavity on either side of ostium. Ostium wide. Colliculum very narrow,

with a very deep emargination at ostium and laterally compressed and dilated at base of ductus. Ductus moderately long and wide, membranous. Bursa very small, rounded. Signum heart-shaped, with a much prolonged, very acute apex.

RANGE AND HABITAT
Forests and wooded habitats from Sierra Leone to the Cameroons, Congo, Zambia, Rhodesia and Tanzania.

EAST AFRICAN RECORDS
TANZANIA BM : Kilosa, Mikindani (Type).

ANTINEPHELE EFULANI Clark 1926.
Proc. New Engl. zool. Cl. **9:** 53. Cameroons.

ANTINEPHELE MUSCOSA Holland 1892.
Trans. Amer. ent. Soc. **16:** 70 (Benita, Gabon, ♀).
Similar to *A. lunulata*, but may be distinguished by the straighter termen and in fresh specimens by the bright blue-green colour of the abdomen.
RANGE: Ghana to Gabon. One specimen from Rhodesia may belong here according to Pinhey.

ANTINEPHELE MACULIFERA Holland 1889. (V; 11)
Trans. Amer. ent. Soc. **16:** 69 (Benita, Gabon, ♂).

Sexes alike. Fw. 22–24 mm. Head and tegulae very dark brown. Posterior portion of thorax and base of abdomen pale brown with a prominent dark brown dorsal spot. Rest of abdomen above bright orange, shading to light brown on dorsum. Head and body whitish below. Fw pale pinkish brown mottled with olive and with pinkish, with a number of faint, irregular dark lines. A prominent triangular dark brown spot at base and two or more conspicuous dark brown spots in distal part of wing. Hw uniformly dark brown.
♂ GENITALIA: uncus strongly compressed laterally, with a sharply downcurved, heavily sclerotised terminal hook. Gnathos shorter, slender, not apically sclerotised. Saccus short and rounded. Valve fairly rounded, with a number of stiff bristles near base. Modified scales narrow and long, 7–8 in number, *not* set in a straight line. Harpe very short, upcurved. Aedeagus with a short simple terminal spine. Vesica with a short apical spine.

♀ GENITALIA: vaginal plate ill-defined. Colliculum short and wide, slightly pointed to the left. Ductus saccate at base, fairly long and slender. Bursa elongated, pitted but not ribbed. Signum unlike previous species, very long and slender, shaped like a blade of grass, without spines or papillae.
EARLY STAGES: unknown.

RANGE AND HABITAT
Sierra Leone to the Congo and Uganda. Also in Malawi, Tanzania and Rhodesia. Forests and wooded habitats.

EAST AFRICAN RECORDS

UGANDA	NM :	Entebbe, Kamengo.
	SM :	Budongo forest.
	BM :	Elgon.
	K :	Kawanda.
TANZANIA	R :	Ilonga.

TEMNORA Walker 1856

List. Lep. Ins. B.M. **8:** 114; type species *Temnora natalis* Walker 1856.
1856 *Diodosida* Walker *l.c.* : 163; type species *D. murina* Walker 1856.
1847 *Lophuron* Boisduval in Deleg. *Voy. Afr. Austr.* : 549; type species ? *Sphinx pylas* Cramer 1779.
1875 *Ocyton* Boisduval *Spec. gen. Lep. Het.* **1:** 303; type species *Ocyton tyrrhus* Boisduval 1875= *Temnora murina* (Walker) 1856.
1875 *Aspledon* Boisduval *l.c.* **1:** 305; type species *Aspledon dorus* Boisudval 1875=*Lophura zantus* Herrich-Schaffer 1854.
1889 *Eulophura* Holland *Trans. Amer. ent. Soc.* **16:** 58; type species *Eulophura atrofasciata* Holland 1889.

A purely Ethiopian genus of small to medium-sized species. Head crested; eyes with short cilia. Palpi projecting beyond frons, fully scaled internally, or with a very small bare patch on 2nd joint. Antennae slightly clubbed, hooked, last segment long; cilia of antennae short in male. Abdomen with slender elongated spines. Anal tuft of ♂ truncated, of ♀ very thin. The males of most species have 2 tufts of fine hairs on first abdominal segment below which are often red or pink and are only visible when extruded. Tibiae unarmed, spurs unarmed, 2 pairs on hindtibia. Tarsi spinose, mid-tarsus with a priminent posterior comb. Wing margins entire, or with a slight emargination below apex, or irregularly dentate. Costa of hw lobed in some species. Lower angle of discoidal cell somewhat produced, origin of veins 3 and 4 well separated. Lower angle of discoidal cell strongly produced in hw, the cubitus being much longer than the radius; veins 6 and 7 arising contiguously, or on a short stalk. Male genitalia of the usual pattern with undivided uncus, well developed undivided gnathos, short broad saccus, regular single lobed valve, short simple harpe.A few (4–6) large modified scales usually in a straight line, sometimes set in a slight ridge parallel to the dorsal margin of the valve. These scales are highly deciduous and easily lost during dissection; sometimes they appear to have been lost in life, possibly during copulation. Aedeagus usually with a latero-apical spiny hook or plate. Vesica armed with one or more stout spines, or with numerous spicules of varying length. The spicules are sometimes lost in the bursa of the female during copulation, and the vesica appears unarmed when dissected.

The larvae usually have the thoracic segments tapering towards a rather small round head. Pupae with proboscis case protruding a little beyond head, but not keeled below.
There are about 45 species, most of which appear to feed on flowers. The females appear to be crepuscular and are seldom attracted to light, although often caught on flowers; the males fly later and come frequently to MV light.

Temnora is a very compact genus and cannot be rationally subdivided, nor can the structure of these insects be used as a guide to a convincing phylogenetic sequence. The order followed here has been based largely on wing shape and general appearance.

TEMNORA STEVENSI R. & J. 1903.
Novit. zool. **9** *suppl.* : 571 (Suza country, Sierra Leone, ♂).
Forests from Sierra Leone to the southern Congo.

TEMNORA SWYNNERTONI Stevenson 1938.
Trans. Rhod. sci. Assoc. **36** (1): 146 (Mount Selinda, S. Rhodesia).
Apparently confined to the eastern border of Rhodesia.

TEMNORA FUMOSA (Walker) 1856.
Zonilia fumosa Walker *List. Lep. Ins. B.M.* **8:** 193 (Congo, ♂).

Ssp. *fumosa*. (V; 12)
1894 *Diodosida fallax* Rothschild *Novit. zool.* **1:** 72 (nomen nudum).

Sexes alike. Fw. 22–28 mm. Margin of fw entire, with a small emargination below apex. Fw olive brown to dark olive brown, with several oblique darker bands, which are less visible in dark specimens. Apical area somewhat paler. A greyish mark at costa $\frac{3}{4}$ from base. Hw darker brown, unmarked. Abdominal tufts of ♂ fairly bright red.

♀ GENITALIA: postvaginal plate linguiform. Colliculum straight, wide and fairly long. Ductus very long, minutely pitted. Bursa pleated, sock-shaped. Signum a long narrow longitudinal plate pointed at both ends, densely covered by minute teeth.

EARLY STAGES: (after D. G. Sevastopulo).
LARVA, LAST INSTAR: head green, rounded. Body pale green, speckled along the secondary segmental divisions with white. A subdorsal white line edged above with darker green. The ground colour paler below the subdorsal area. Legs pale green, ringed with black. Prolegs and venter pale green. Horn stout, slightly downcurved, greenish-blue with minute black tubercles. Spiracles white with the central slit black. Becomes suffused with purple when preparing to pupate.

PUPA: in a very slight cocoon among litter on the surface of the soil. Olive minutely speckled with black. A black dorsal line. Venter with the median area whitish speckled with black and with a double black central line. Spiracles black set in whitish spots. Cremaster triangular, minutely bifid at apex. Metathorax and 1st abdominal segment with a subdorsal depression above wing case. Except for the wing cases, clothed in a short dark pubescence.

HABITAT AND RANGE
Most habitats throughout Africa south of the Sahara. One of the commonest species.
EAST AFRICAN RECORDS

KENYA	NM :	Aberdares, Thomson's Falls.
	SM :	Kitale.
	S :	Mombasa.
UGANDA	NM :	Entebbe, Kamengo, Masaka.
	SM :	Budongo, Katera.
	L :	Mweya.
TANZANIA	NM :	Amani, Ukerewe.
	R :	Arusha, Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea.

Ssp. *peckoveri* (Butler) 1877.
Diodosida peckoveri Butler *Trans. zool. Soc. Lond.* **9:** 637 (Madagascar).
Madagascar, Comoros, Seychelles.

TEMNORA LEIGHI R. & J. 1915.
Novit. zool. **22:** 287.
Comoro Islands.

TEMNORA ALBILINEA Rothschild 1904. (V; 13)
Novit. zool. **11:** 436 (Angola, ♂).
1913 *Temnora albilinea obscurascens* Strand *Arch. Naturgesch.* **79** A6: 110 (Ujiji, Tanganyika).

Sexes alike. Fw. 25–27 mm. Body and both wings very dark olive when fresh, fading to dark orange-

brown. Margins entire, apex of fw acuminate, and slightly falcate, fw narrow and long. Fw with a very fine curved whitish line from tornus to costa; apical area paler. Abdominal tufts of ♂ red. The type is very faded and *T. A. obscurascens* Strand was merely a fresh specimen.
♂ GENITALIA: uncus stout and rather short; gnathos shorter, apically dentate. Harpe short, slender, smooth, sharply upcurved. Aedeagus armed with an apical dentate plate on the left side and with a sharp smooth hook-like process on the right. Vesica armed with numerous long spicules.

♀ GENITALIA: 8th tergite with a median tongue-like process. Post-vaginal plate longitudinal, long and narrow, apically curved. Ante-vaginal plate very broad, consisting of 2 wide, curved lateral lobes separated by a wide, shallow, mesial sinus. Ostium very wide. Ductus completely membranous, wide and long. Bursa pleated, apically pitted, very long, not much wider than ductus. Signa absent.
EARLY STAGES: unknown.

HABITAT AND RANGE
Forests from the Cameroons to Angola, the Congo, Uganda, Kenya and Tanzania.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Kamengo, Mweya.
	SM :	Katera.
TANZANIA	NM :	Amani.
	MB :	Ujiji, (Type of *obscurascens* Strand).

TEMNORA ARGYROPEZA (Mabille) 1879.
Chaerocampa argyropeza Mabille *Bull. Soc. philom.* (7) **3:** 135 (Nossi-bé, Madagascar, ♂).
1879 *Ocyton tyrrhus* id. *Ann. Soc. ent. France :* 299. Madagascar only.

TEMNORA MARGINATA (Walker) 1856.
Darapsa marginata Walker *List. Lep. Ins. B.M.* **8:** 185 (Natal, ♂).
1894 *Diodosida brunnea* Rothschild *Novit. zool.* **1:** 72 (Namaqualand).

Ssp. *marginata*. (V; 14)
Sexes alike. Fw. 21–23 mm. Apex of fw slightly acuminate, outer margin incurved below apex and above tornus, convex at middle. Head, body and fw dark greyish cinnamon. A broad dark band proximally well defined, distally diffuse from tornus to costa, much broader at costa. Basal and apical areas with indistinct narrow wavy lines, termen dark brown. Hw dark rufous cinnamon brown, with a dark brown border and whitish internervular cilia. Underside paler, more rufous, with basal area of fw blackish. Foretibiae silvery white. Abdominal tufts of ♂ paler than body.

♀ GENITALIA: vaginal plates ill-defined. Ostium wide, with a small projection at each side. Colliculum tapering, pointing to the left. Ductus very long and narrow. Bursa pear-shaped, smooth. Signum a long, straight, narrow, sparsely tuberculate plate not terminally pointed.

HABITAT AND RANGE
Savanna and woodland in eastern and southern Africa.
EAST AFRICAN RECORDS

KENYA	NM :	Kibwezi, Shimba Hills, Gazi, Sokoke forest.
TANZANIA	NM :	Mlingano.
	R :	Dar es Salaam, Ukiriguru, Ilonga.

Ssp. *comorana* R. & J. 1903.
Novit. zool. **9** *suppl.* : 573 (Grande Comore, ♂). Comoro Islands only.

TEMNORA BURDONI sp. nov. (X; 6—XIV; 1)

Closely allied to *T. marginata* Walker, but differs in its smaller size, longer and thicker antennae, reddish colour of hw above and of base of fw below and in the structure of the male genitalia.

MALE

ANTENNAE: long, thick, strongly clubbed, liver brown, but much paler at apex and below; pectinations rather long.
HEAD: frons and vertex liver brown, eyes with prominent liver brown cilia. Palpi liver brown above, pecan brown below.
THORAX AND ABDOMEN: liver brown above, pecan brown below. Abdominal tufts pecan brown.
LEGS: foretibiae and tarsi white; forefemora and 2nd pair of legs pecan brown, but somewhat paler than abdomen; 3rd pair missing.

UPPERSIDE

FOREWING: apex slightly acuminate; termen incurved from below apex to end of vein 3; tornus slightly produced; length of fw 22 mm. Ground colour liver brown with a slight violet gloss. Basal, subbasal and antemedial vandyke brown, very faint, A broad, diffuse vandyke brown fascia from middle of costa to tornus, interrupting faint, double postmedial. Apical third of wing slightly paler than basal area. Submarginal rather faint, crenulated, thicker and better defined near costa. Marginal area vandyke brown from immediately below apex to end of vein 3. Two faint paler spots with diffuse edges in area 2, just inside diagonal dark fascia. Cilia vandyke brown.
HINDWING: margins slightly crenulate, tornus slightly produced; brick red with a narrow dark brown margin. Cilia very pale buff except at ends of veins, where they are dark brown.

UNDERSIDE

FOREWING: basal $\frac{3}{4}$ uniform brick red, paler at costa and inner margin; apical and marginal areas paler (pecan brown); three short parallel blackish crenulate transverse lines, not reaching inner margin; the distal one from costa at $\frac{2}{3}$ from base, very short; the two distal ones progressively longer. A complete, irregular, faint blackish submarginal line at an angle to the three short lines.
HINDWING: pecan brown speckled with darker scales, three faint curved, parallel crenulate transverse lines from costa to inner margin. A complete dark terminal band, broader at apex, narrower at tornus.

GENITALIA: of the usual Semanophorine pattern common to all members of the genus. Uncus slender, downcurved, apically smooth and bulbous. Gnathos slightly shorter, narrower than in *T. marginata*, terminating in a curved vertical dentate ridge. Saccus broad, short and rounded. Valve of the usual pattern, apically pointed. Modified scales lost, but three sockets clearly visible on outer surface of valve, near dorsal margin. Harpe ventral, almost reaching middle of valve margin, smooth, slender, apically pointed, slightly upcurved. Aedeagus fairly long, straight, tapering from base to apex. Vesica armed ventro-basally with a broad spinose plate which is attached to the ventral surface of the aedeagus before the apex and folded into the aedeagus when the vesica is not extruded.
FEMALE: unknown.

HOLOTYPE ♂: Mufindi, Iringa, Tanganyika, II-1960, P. Burdon, to be deposited in the British Museum (Natural History).
This species is known from the Holotype only and is dedicated to its discoverer, Dr. P. Burdon.

TEMNORA FUNEBRIS (Holland) 1893. (V; 20)
Diodosida funebris Holland *Ent. News* **4:** 340 (Benita, Gabon).
1938 *Polyptychus vumbui* Stevenson *Trans. Rhod. sci. Assoc.* **36:** 141 (Vumba, Rhodesia, ♀).

Sexes alike. Fw 23–29 mm. Very similar to *T. marginata*, but larger, wings longer and narrower, termen of fw much more oblique, tornus less prominent. Foretibia white, abdominal tufts long, cinnamon brown, paler than abdomen. Anal tuft longer and more slender than in *T. marginata.*

♀ GENITALIA: postvaginal plate tongue-shaped, small. Antevaginal plate a rough, wide crescent with blunt apices, transversely rugose. Ductus entirely membranous, very long, minutely pitted near base. Bursa long and narrow, pleated. Signa absent.
EARLY STAGES: unknown.

HABITAT AND RANGE
Forests from West Africa to the Congo, Uganda, Tanzania and Rhodesia.
EAST AFRICAN RECORDS

UGANDA	NM	:	Kayonza (Kigezi), Katera.
	BM	:	Bwamba.
TANZANIA	NM	:	Mufindi, Mbimba (Mbeya).
	MC	:	Lindi, Songea.

TEMNORA ANGULOSA R. & J. 1906.
Novit. zool. **13:** 182 (Congo).
1951 *Temnora bicolor* Gehlen *Rev. Zool. Bot. afr.* **44:** 252. Nigeria to the Congo.

TEMNORA ATROFASCIATA (Holland) 1889. (V; 15,16)
Eulophura atrofasciata Holland *Trans. Amer. ent. Soc.* **16:** 59 (Benita, Gabon, ♂).
1894 *Lophuron umbrinum* Rothschild *Iris* **7:** 29 (Sierra Leone, ♀).

♂: fw. 22 m., fairly broad; apex produced, but rather blunt; termen strongly emarginate between apex and vein 5, and slightly incurved before tornus. Tornus acute, somewhat produced. Body and fw brown. A broad dark brown band from tornus to costa, straight and well defined proximally, irregular and strongly indented distally; apical area paler than basal area. Hw very dark brown, slightly paler at costa. Abdominal tufts buff.

♀: fw. 24 mm., broader than in ♂, with much more regularly rounded margins. Ground colour darker, wide dark band much less contrasting. Dark band merging distally with paler apical area.
GENITALIA: postvaginal plate roughly rounded, median area densely covered with minute tubercles. Colliculum fairly long and wide, curved to the left. Ductus long and narrow, densely pitted. Bursa oblong, smooth. A minute basal signum consisting of a few contiguous but irregularly arranged large tubercles surrounded by an area closely studded with minute papillae. A much larger rectangular, transverse subapical signum armed with stout blunt spines and similarly surrounded by small papillae.
EARLY STAGES: unknown.

RANGE AND HABITAT
Forests from W. Africa to the Congo and Uganda, with an apparently isolated population in the Usambara Mountains.
EAST AFRICAN RECORDS

UGANDA	BM	:	Kamengo.
TANZANIA	BM	:	Amani.

TEMNORA LIVIDA (Holland) 1889. (V; 19)
Chaerocampa livida Holland *Trans. Amer. ent. Soc.* **16:** 63 (Benita, Gabon, ♀).

The largest species of the genus. Sexes alike. Fw. 29–34 mm. Head and body grey, with a dark median line from vertex to base of abdomen. Fw grey with numerous indistinct crenulate dark lines. A darker area at costa, near apex and a squarish dark spot at inner margin before tornus. A large, diffuse darker area beyond middle of costa. Apex of fw acute, slightly falcate, termen regular and entire. Hw uniformly dark blackish grey with a pale grey spot at tornus. Abdominal tufts light red.

♀ GENITALIA: post-vaginal plate a narrow sclerotised strip. Ante-vaginal plate a wide, smooth flap. Colliculum wide and extremely short. Ductus slender and very long. Bursa large and rounded, pitted and slightly pleated. Signum a long narrow transverse plate across base of bursa, armed with strong spines.

RANGE AND HABITAT
Forests from Gambia to the Congo and Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Katera.
B : Kabanyolo, (Kampala).

TEMNORA REUTLINGERI (Holland) 1889.
Ocyton reutlingeri Holland Trans. *Amer. ent. Soc.* **16:** 61 (Benita, Gabon, ♂).
Nigeria to Gabon.

TEMNORA GRISEATA R. & J. 1903. (V; 17,18)
Novit. zool. **9** *suppl.* : 568 (Tvoko, Congo, ♀; type lost).
1912 *Temnora cinereofusca* Strand (*Arch. Naturgesch.* **78** A: 155 (Luluabourg, Kasai, ♀).
1916 *Temnora griseata* R. & J. *Novit. zool.* **23:** 119 (Nigeria, ♂).
1916 *Temnora oxyptera* R. & J. *Novit. zool.* **23:** 120 (Chintechi, Nyasaland, ♂ syn. nov.).
1935 *Temnora reutlingeri acra* Gehlen *Ent. Z.* **49:** 11 (Manow, S. Tanganyika, ♂ and ♀).

The status of this species is in some doubt owing to the fact that the type, which was a ♀, and should be in the Musée Royal de l'Afrique Centrale at Tervuren, Belgium, has been lost and owing to the instability of the diagonal band of the forewing.
It is possible that *T. griseata* is a synonym of *T. reutlingeri* Holland, the type of which (a ♂) is in the Carnegie Museum at Pittsburgh and therefore inaccessible. According to the figures of the types of the two species in Rothschild and Jordan's Monograph (*op. cit.*, Plate VII, figs. 9 and 16), *T. griseata* is much larger and lacks the diagonal band, whereas *T. reutlingeri*, which is a good deal smaller, has a well developed diagonal band. There is a ♀ from Calabar, Nigeria, in the National Museum which agrees very well with the figure of *T. reutlingeri* and which has genitalia which differ from those of Uganda ♀♀ provisionally placed in *T. griseata.* Unfortunately the bursa and ostium of *griseata* which carry good diagnostic characters, were not figured in the original description and it is consequently impossible to know whether it was the ♀ of *reutlingeri*, or whether it was indeed a good species. There is also some doubt about the Neallotype ♂ of *griseata*, described in 1916, as it may have been wrongly associated with the original ♀. The possibilities are therefore as follows:—

(1) The types of *griseata* and *reutlingeri* belong to 2 distinct species and the Calabar specimen in the National Museum is the ♀ of *reutlingeri* and the Neallotype ♂ of 1916 was correctly associated with the ♀ of *griseata*.
(2) *Griseata* 1903 is the ♀ of *reutlingeri*, and the Calabar ♀ belongs to an undescribed species. In this

case, if the ♂ *griseata* of 1916 agrees with the type of *reutlingeri* (also a ♂), the name *griseata* should sink into synonymy. If the ♂ *griseata* does *not* agree with *reutlingeri*, the name *cinereofusca* Strand 1912 is the earliest name available for it. The type of *cinereofusca* which is in the Berlin Museum has been examined and agrees very well with the Neollotype ♂ of *griseata*, with the Holotype ♂ of *T. oxyptera* R. & J. 1916 and with *T. reutlingeri acra* Gehlen 1935.

As stated earlier, this confusion is partly due to the instability of the diagonal bar of the fw. which is present in the type of *reutlingeri*, in the Calabar ♀ (but not so distinct), in the type of *cinereofusca*, and in one of the two ♂♂ figured by Gehlen as *acra*, but less distinct in the other; it is completely absent in the Holotype and Neallotype of *griseata* and in the Holotype of *oxyptera;* a B.M. ♂ specimen from Tukuyu, S. Tanzania, near the type locality of *acra*, has a very faint bar, and a series of 14 ♂♂ in the National Museum from Uganda, the Congo and Gabon show every gradation from a complete absence of the bar to a very well marked one; 2 ♀♀ from Uganda in the National Museum have a well developed bar. Until more material and information become available, it will be best to treat *reutlingeri* and *griseata* as distinct and to apply the latter name to the East African populations. The following description is based on the ♂ from Tukuyu in the British Museum.
♂: fw. 25 mm. Antennae strongly clubbed and sharply hooked, Vertex and pronotum with a prominent crest. Head and body grey. Fw with acute, slightly falcate apex, evenly curved, entire termen and rather blunt tornus. Fw grey with faint indications of a straight dark bar from middle of costa to tornus. A large dark grey spot at costa, immediately before apex. Several very faint irregular dark transverse lines marked by minute dark dots on the veins. Cilia whitish except near apex and at the veins. Hw uniformly dark greyish-brown; cilia whitish, except at the veins. Abdominal tufts very light red.
GENITALIA: uncus downcurved, of medium length and thickness. Gnathos very short and broad, apically bisinuate. Valve apically pointed, with a prominent ridge parallel to dorsal margin, to which five large modified scales are attached. Harpe rather short, smooth and slender, sharply upcurved. with blunt apex and slightly incrassate before apex. Aedeagus straight, tapering gradually from base; a broad spinose plate proximally attached to ventral surface before apex, distally protuding beyond apex and attached to base of vesica. Vesica armed with a single sharp apical spine.

♀ (based on R. & J's. description and figure, *Novit. zool.* **9** *suppl.* : 568): Fw. 27 mm. Similar to ♂, but broader winged, apex of fw not so acute, diagonal bar lacking.
GENITALIA: not figured, specimen lost.

2 ♂♂ in the National Museum from the Congo and Gabon have a more slender, longer harpe than the Tukuyu ♂. The diagonal bar is present in the Gabon specimen, absent in the Congo specimen.

RANGE AND HABITAT

Forests from Nigeria to the southern Congo, southern Tanzania and Malawi.

EAST AFRICAN RECORDS

TANZANIA	BM :	Tukuyu.
	MB :	Manow.
	NM :	Mbimba.

The Uganda population of this species, represented by 12 ♂♂ and 2 ♀♀ in the National Museum and by 6 ♂♂ and several ♀♀ in the British Museum is quite distinct, but it is deemed unwise to propose a name for it until the taxomnic confusion surrounding this species has been cleared up. Nevertheless, a brief descrption appears desirable.

♂: fw. 21–22 mm. Ground colour of body and of fw paler than in the Tukuyu specimen, with a very slight ochreous tinge. Specimens with a well marked dark diagonal bar, have a dark dorsal line from the vertex to the end of the abdomen. Underside pale clay coloured, not pinkish as in the Tukuyu specimen. Abdominal tufts pale clay-coloured.

GENITALIA: as in the Tukuyu specimen, but harpe longer and more slender, dentate plate of aedeagus narrower.

♀: fw. 24 mm. Similar to ♂, but ground colour darker, diagonal bar present. Dorsal line absent. 1 specimen has the same underside as the ♂, the other has a pinkish underside, like the Tukuyu ♂.
GENITALIA: post-vaginal plate ill-defined. Ante-vaginal plate broad, bisinuate anteriorly. Ostium wide, Colliculum wide and rather short, slightly directed to the left. Ductus long and narrow, with numerous minute papillae at the base. Bursa pear-shaped, ribbed and covered by small papillae. Basal signum fairly large, more or less rounded, armed with strong spines. Subapical signum a rather long, wide longitudinal rod armed with strong spines.

EAST AFRICAN RECORDS
UGANDA NM : Katera (Sango Bay), Kamengo.

TEMNORA ROBERTSONI sp. nov. (X; 3—XIV; 5)

Allied to *T. griseata* R. & J., but differs in the heavily marked fw and in the structure of the ♂ genitalia.

MALE
ANTENNAE: rather short, of even thickness, abruptly hooked, very pale grey. Pectinations very short.
HEAD: frons and vertex drab, palpi drab. A prominent darker crest on vertex, extended to thorax.
THORAX AND ABDOMEN: drab above, pinkish buff below. Abdominal tufts long, light red.
LEGS: first two pairs missing. Third pair very light pinkish buff speckled with brown scales.

UPPERSIDE
FOREWING: apex rather blunt, not falcate; termen slightly incurved below apex and above tornus; tornus rather strongly produced. Length of fw 23 mm. Ground colour drab; a broad sepia band from immediately above tornus to middle of costa, widening abruptly from vein 3 to costa, where it is 3 times wider than at tornus. Traces of a very faint double subbasal and of a double antemedial at inner margin. Postmedial faintly indicated and parallel to outer margin of dark band from costa to vein 3, reappearing at inner margin below tornus. A triangular sepia spot at costa before apex followed by nervular dark spots, indicating submarginal line. Termen sepia from apex to just beyond vein 5 and from vein 2 to tornus. Cilia sepia from apex to vein 4, thence light buff except at the veins, where they are sepia.
HINDWING: uniformly sepia, with a faint reddish tinge in discal area; a diffuse grey spot at tornus and faint grey streaks along veins 3 and 4, near margin. Tornus somewhat produced, cilia light buff.

UNDERSIDE
FOREWING: pinkish buff with a large fuscous basal area not extending to the costa. Three narrow crenulate parallel transverse lines, the inner at $\frac{2}{3}$ from base at the costa. A faint straight dark line from apex merging with outer crenulate line at vein 5. Apex drab, followed by a very diffuse darker marginal spot extending to vein 6; remainder of outer marginal area more greyish than rest of wing.
HINDWING: pinkish buff with 3 faint, crenulate parallel curved lines from costa to inner margin.

GENITALIA: uncus long, straight and narrow, heavily sclerotised apically, but without terminal hook. Gnathos almost as long, slightly upcurved, apically dentate and heavily sclerotised. Saccus wide, rounded and longer than in most species of *Temnora*. Valve elongated, sole-shaped, with a longitudinal ridge near dorsal margin in which 6 large modified scales are set. Harpe smooth, fairly long and slender, apically upcurved and provided with a thin vertical blade connecting the apex to the base. Aedeagus long, slender, slightly curved, armed apically with a long narrow spinose longitudinal ridge which is prolonged into a slender reflexed hook with a few apical spines. Vesica armed with numerous very long spicules.

FEMALE AND EARLY STAGES: unknown.

HOLOTYPE ♂: Tanganyika, Mlingano, 20–1–1964, I. A. D. Robertson, taken at light; to be deposited in British Museum (Natural History).
This species is known from the Holotype only, and is dedicated to its discoverer.

TEMNORA NEPHELE Clark 1922.
Proc. New Engl. zool. Cl. **8:** 12 (Cameroons) Spanish Guinea to the Cameroons.

TEMNORA ELISABETHAE Hering 1930. (V; 21)
Rev. Zool. Bot. afr. **17:** 406 (Belgian Congo, ♂).

Sexes alike. Fw. 21–24 mm. Apex fairly acute, termen concave at vein 4. Fw, head and body dark grey. Fw with a large dark brown triangular spot at middle of costa, with apex prolonged into a slightly curved line to tornus. A smaller dark brown spot at costa, before apex. Numerous irregular dark narrow transverse lines. Hw uniform very dark brown. Underside bright pinkish buff lined with fuscous; basal $\frac{2}{3}$ of fw fuscous. Abdominal tufts pink.

♀ GENITALIA: postvaginal plate roughly triangular. Anti-vaginal plate not sclerotised, ostium very wide. Colliculum very wide at ostium, tapering, directed to the left; ductus short, narrow, pitted. Bursa very long and narrow, pitted and pleated. 1 large rounded basal signum armed with strong spines.
EARLY STAGES: unknown.

HABITAT AND RANGE
Forests from the Congo to Uganda.
EAST AFRICAN RECORDS

UGANDA	NM :	Kamengo, Entebbe, Mabira, Katera, Makerere, Budongo.
	BM :	Kampala.
	B :	Nakawa.

TEMNORA SUBAPICALIS R. & J. 1903. (V; 22)
Novit. zool. **9** *suppl.* : 572 (Kikuyu Escarpment, Kenya, ♀).

♂: fw. 24 mm. Very similar in size, shape and markings to the previous species, but ground colour of both wings rich cinnamon brown, not grey. Diagonal bar from tornus to costa, straight narrow, well defined, not dilated at costa; a dark dorsal line from head to apex of abdomen. Fore and mid-tibiae whitish, abdominal tufts of ♂ cinnamon.
GENITALIA: very similar to *T. griseata;* uncus short, evenly downcurved, apically blut. Gnathos almost as long as uncus, apically bisinuate. Subdorsal ridge and modified scales present on valve. Harpe smooth, sharply upcurved, apically pointed. Spinose subapical plate of aedeagus very much broader than in *T. griseata.* Vesica armed with a single stout apical spine.

♀: fw. 26 mm. Wings broader and more rounded; diagonal bar dilated distally to form a large dark brown patch with diffuse outer edge.
GENITALIA: post-vaginal plate reduced to two narrow lateral arms flanking the ostium. Ante-vaginal plate large, smooth, with anterior margin rounded and slightly sinuate. Colliculum wide and very short. Ductus slender and moderately long. Bursa small, ovoid and rugose, densely covered by small papillae. Basal signum transverse, consisting of two lateral sclerotised irregularly spinose plates connected by a lightly sclerotised bridge. Subapical signum a small irregular dentate plate.

HABITAT AND RANGE

Apparently very rare; highland forest in central Kenya and also in Rhodesia, according to Pinhey.

EAST AFRICAN RECORDS

KENYA	NM :	Limuru.
	BM :	Kikuyu Escarpment (Type), Uplands.

TEMNORA IAPYGOIDES (Holland) 1889.

Ocyton iapygoides Holland *Trans. Amer. ent. Soc.* **16:** 60 (Benita, Gabon, ♂).
1891 *Ocyton preussi* Karsch *Ent. Nachr.* **17:** 292 (Barombi, Cameroons).
1894 *Pterogon clementsi* Rothschild *Novit. zool.* **1:** 69 (Sierra Leone).

Ssp. *iapygoides*. (XIV; 12)

Sexes alike. Fw. 18–20 mm. Very similar to *T. subapicalis* R. & J., but rather smaller, more narrow winged. Diagonal bar broader, margins more diffuse, hw a little paler, underside brighter. Abdominal tufts of ♂ long, very pale.

♀ GENITALIA: post-vaginal plate an irregular transverse ridge with deep parallel transverse folds. Ante-vaginal plate slightly sclerotised at the sides only. Colliculum long, tapering towards ductus. Ductus rather short, straight, sclerotised and fluted. Bursa small and rounded, pitted and pleated, sclerotised at base. Signum a small apical spinose rounded plate.

HABITAT AND RANGE

Forests from Sierra Leone to the Congo and Uganda.

EAST AFRICAN RECORDS

KENYA	NM :	Kericho.
UGANDA	NM :	Kawanda, Katera, Fort Portal, Budongo, Bwamba, Kayonza.
	BM :	Sesse Islands, Kampala, Kamengo.

Ssp. *pernix* Kernbach 1962. (V; 25)
Mittel. Deutsch. ent. Ges. Jahrg. **21,** 4: 53 (Southern Rhodesia).

A race of doubtful validity. Slightly larger (fw 20–22 mm.); ground colour brighter, markings heavier, better defined. Amani specimens have the colour and markings of topotypical specimens from Rhodesia, but are smaller. South Congo specimens have the same coloration as Uganda and West African specimens, but agree with *pernix* in size.

RANGE: Rhodesia, Zambia. Malawi and Tanzania to the Kenya Coast.

EAST AFRICAN RECORDS

KENYA	S :	Mombasa.
TANZANIA	NM :	Amani.
	R :	Mlingano, Ilonga.

TEMNORA ERANGA (Holland) 1889. (V; 23—XIV; 10)

Ocyton eranga Holland *Trans. Amer. ent. Soc.* **16:** 61 (Kangwe, Ogowe, ♀).
1931 *Temnora heringi* Gehlen *Ent. Z.* **45:** 203 (Lake Tanganyika, ♂) syn. nov.

Sexes alike. Fw 16–18 mm. Very similar to previous species, but smaller, ground colour much paler, buffish, markings much more clearly visible, hw with a submarginal series of angular buff spots. Abdominal tufts of ♂ apparently missing.

♀ GENITALIA: post-vaginal plate irregular, with ill-defined posterior margin and with 4 deep longitudinal folds. Ante-vaginal plate a small, regular crescent. Colliculum short, tapering abruptly at ductus. Ductus long and narrow. Bursa of moderate size, ovoid, pitted, but not pleated. Signum a narrow, transverse spiny plate at base of bursa.

HABITAT AND RANGE
Forests from Sierra Leone to the Congo and Uganda and west Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Katera, Kalinzu, Budongo.
	B :	Nyabyeya.

TEMNORA SCITULA (Holland) 1889. (V; 24)
Ocyton scitula Holland *Trans. Amer. ent. Soc.* **16:** 60 (Benita, Gabon, ♂).

Sexes alike. Fw. 19–23 mm. Wing margins less crenulated, more regular than previous species. Body brown above; crest very dark brown, a dark brown triangle with pale margins on each tegula. Fw brown, marked and much variegated with dark brown and with several creamy buff spots in the distal part of the wing. Hw reddish brown with a dark margin and a submarginal series of angular pinkish buff spots. Underside spotted with orange brown and cream; a small ventral creamy spot on each abdominal sternite. Abdominal tufts of male buff.

♀ GENITALIA: very similar to *T. eranga*, but ventro-posterior margin of colliculum very deeply incised at ostium.

HABITAT AND RANGE
Forests from Gambia to the Congo, Angola and Uganda; an isolated but typical population in E. Tanzania.
EAST AFRICAN RECORDS

UGANDA	NM :	Mabira, Katera, Fort Portal, Kalinzu, Budongo, Bwamba, Kayonza.
	BM :	Kamengo.
	B :	Nyabyeya.
TANZANIA	NM :	Amani, Mbimba.

TEMNORA ENGIS Jordan 1933.
Novit. zool. **38:** 342 (♂). Madagascar.

TEMNORA CATALAI Griveaud 1959.
Faune Madag. **8:** 71 (♂). Madagascar.

TEMNORA NITIDA Jordan 1920.
Novit. zool. **27:** 160. Madagascar.

TEMNORA INORNATA (Rothschild) 1894.
Lophuron inornatum Rothschild *Novit. zool.* **1:** 71 (Namaqualand, ♂). South Africa.

TEMNORA MURINA (Walker) 1856.
Diodosida murina Walker *List. Lep. Ins. B.M.* **8:** 163 (Natal). South Africa.

TEMNORA NAMAQUA R. & J. 1903.
Novit. zool. **9** *suppl.* : 571 (Little Namaqualand, Cape, ♂). South Africa.

TEMNORA GRANDIDIERI (Butler) 1879.
Diodosida grandidieri Butler *Ann. Mag. nat. Hist.* (5) **4:** 234. Madagascar.

TEMNORA ELEGANS (Rothschild) 1894. (V; 27)
Diodosida elegans Rothschild *Iris* **7:** 298 (Sierra Leone).

Ssp. *elegans*.
West Africa.

Ssp. *polia* Rothschild 1904.
Novit. zool. **11:** 437 (Angola, ♂).

Smaller and greyer, particularly below, than the typical race. East African specimens are somewhat intermediate to ssp. *elegans*.
Sexes alike. Fw. 18–21 mm. Apex of fw acute, margin incurved to vein 4, thence regularly crenulate to tornus. Body and fw grey. Fw with numerous irregular transverse lines and a heavier oblique fascia from tornus to just beyond middle of costa. Hw crenulate, uniform light brick-red, with a narrow dark margin and whitish cilia between the veins. Abdominal tufts of male bright red.

♀ GENITALIA: postvaginal plate incurved at ostium, produced at posterior margin and laterally as far as base of anterior struts. Colliculum long and narrow, tapering distally, directed to the left, minutely sculptured and regularly folded transversely, like a half extended concertina. Ductus very long and slender, pitted. Bursa pear-shaped, pleated and pitted. A single small rounded pinose apical signum.

HABITAT AND RANGE
Savanna from Angola to Zambia, Rhodesia, Malawi and East Africa.
EAST AFRICAN RECORDS

KENYA	NM :	Nairobi.
	BM :	Kibwezi.
	S :	Mombasa.
UGANDA	BM :	1 specimen labelled "Uganda", T.H.E. Jackson.
TANZANIA	NM :	Ilonga, Ngurdoto Crater.
	R :	Dar es Salaam, Mbeya, Mlingano, Ukiriguru.
	MC :	Lindi.
	BM :	Kondoa, Kikori, Mwanza, Kilosa, Tendaguru.
ZAMBIA	NM :	Abercorn.

TEMNORA SARDANUS (Walker) 1856. (V; 28)
Enyo sardanus Walker *List. Lep. Ins. B.N.* **8:** 116 (Sierra Leone, ♀).
1894 *Diodosida uniformis* Rothschild *Novit. zool.* **1:** 72 (Sierra Leone).

♂: fw. 19–21 mm. Apex of fw acute, termen sharply produced at vein 5. Body dark grey, thorax with a prominent crest. A dark dorsal spot on last abdominal segment. Fw dark grey with numerous faint, irregular transverse lines. A large dark brown triangle with its base resting on the costa and its apex at the tornus; proximal margin well defined and somewhat curved; distal side straight and diffuse. Terminal area from apex to vein 5 darker than ground colour. Hw uniform greyish brown, with a paler spot at tornus. Abdominal tufts light red.

♀: fw. 23–25 mm. Wings broader, more rounded, termen more regular. Ground colour darker, dark markings more diffuse, less distinct.
GENITALIA: postvaginal plate very small, rectangular. Antevaginal plate large, rounded, very lightly sclerotised. Ostium rounded, colliculum long and wide, directed to the left, distally dilated. Ductus extremely long and slender. Bursa large, elongated, pleated and pitted. One fairly long transverse basal signum, armed with stout curved teeth.

EARLY STAGES: unknown.
HABITAT AND RANGE
Forests and heavy woodland from Sierra Leone to the Congo and Angola, thence to Rhodesia and East Africa.
EAST AFRICAN RECORDS

KENYA	NM	:	Ruiru, Kitale.
	S	:	Mombasa.
UGANDA	BM	:	Entebbe.
TANZANIA	NM	:	Amani, Kigoma.
	R	:	Ilonga, Mlingano.
	BM	:	Nguelo.

TEMNORA PALPALIS R. & J. 1903.
Novit. zool. **9** *suppl.* : 579 (Antanambe, Baie d'Antongil, Madagascar, ♂).
Madagascar only.

TEMNORA AVINOFFI Clark 1916.
Proc. New Engl. zool. Cl. **6**: 109 (Cameroons). Nigeria to Gabon.

TEMNORA CRENULATA (Holland) 1893. (V; 29)
Ocyton crenulata Holland *Ent. News* **4**: 338 (Batanga, Cameroons, ♂).

Sexes alike. Fw. 22–28 mm. Head and body grey. A narrow elevated crest blackish on head, becoming buff on thorax. Apex of fw acute, termen strongly produced at vein 4, strongly crenulate from vein 4 to tornus. Fw grey, mottled and lined with blackish. A reddish brown bar from middle of costa to end of vein 4, more clearly defined distally than proximally. Hw dark greyish brown except at tornus and inner margin, which are grey. A series of pinkish-buff spots at posterior margin of abdominal sternites, and a series of creamy spots at each side. Abdominal tufts bright red.

♀ GENITALIA: 8th tergite with a median triangular process projecting forward. Postvaginal plate with a median linguiform plate covered by minute tubercles and two transverse lateral plates tapering to the base of the anterior struts. Ostium deeply incurved ventrally and anteriorly. Colliculum short and wide, directed to the left. Ductus very long and slender. Bursa pear-shaped; pleated and slightly pitted. Signa absent.
EARLY STAGES: unknown.

HABITAT AND RANGE

Forests from Sierra Leone to the Congo, Uganda and west Kenya, with an apparently isolated population in the Usambara mountains of N.E. Tanzania.

EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
	SM :	Malawa.
UGANDA	NM :	Fort Portal, Kalinzu, Entebbe, Budongo.
	BM :	Kamengo.
	B :	Kabanyolo, Nakawa.
TANZANIA	NM :	Amani.

TEMNORA CAMEROUNENSIS Clark 1923.
Proc. New Engl. zool. Cl. **8:** 62. Cameroons.

TEMNORA CURTULA R. & J. 1908. (V; 30)
Novit. zool. **15:** 260 (Entebbe, ♀).

Sexes alike. Fw. 17–19 mm. Head and body dark purplish grey; head with a very dark prominent crest. Fw crenulate, dark purplish grey lined and mottled with blackish. A blackish subapical bar wider at costa. A black dot followed by a pinkish buff dot at inner margin near tornus. Hw blackish grey with a pale rectangular spot at tornus. Underside very dark grey with a golden dot near tornus of each wing, that on fw much brighter. Abdominal tufts of ♂ bright red.

♂ GENITALIA: almost identical with *T. crenulata*, but gnathos more slender. Valve and harpe as in *crenulata*. Aedeagus armed dextro-ventrally with three stout apical spines. Vesica armed apically with a small irregular plate terminating in a short slender spine.

♀ GENITALIA: very similar to *crenulata*, but ostium wider, colliculum tapering gradually from ostium. Bursa smooth, without signa.

HABITAT AND RANGE

Forests in the Congo, Uganda and west Kenya. Apparently very rare.

EAST AFRICAN RECORDS

KENYA	NM :	Kaimosi.
UGANDA	NM :	Entebbe.
	BM :	Kamengo, Nagunga.

TEMNORA NATALIS Walker 1856. (V; 31)
List. Lep. Ins. B.M. **8:** 104 (Natal, ♂).
1936 *Temnora natalis kafakumbae* Clark *Proc. New Engl. zool. Cl.* **15:** 87 (Kafakumba, Katanga, Congo). Syn. nov.

Sexes alike. Fw. 22–24 mm. Head and body grey. Apex of fw blunt, but margin strongly dentate. Fw grey, subbasal straight, blackish, oblique; a large diffuse blackish spot at costa, at $\frac{2}{3}$ from base. A sagittate black submarginal spot in cellule 3 and another smaller one in 2. Hw crenulate, dark brownish grey, with traces of a blackish submarginal band and grey tornus. Abdominal tufts of ♂ bright red. Ssp. *kafakumbae* Clark is merely a fresh specimen which was darker than the much faded type from Natal.

♀ GENITALIA: very similar to *T. crenulata*, but anterior margin of ostium not incurved, colliculum longer and tapering. Ductus very long and slender. Bursa sock-shaped, pleated and weakly pitted. Signa absent.

HABITAT AND RANGE
Bush and savanna from Natal to Rhodesia, Zambia and Tanzania.
EAST AFRICAN RECORDS

TANZANIA NM : Shinyanga, Ukiriguru.
R : Ilonga, Mbeya, Tabora.

TEMNORA MIRABILIS Talbot 1932. (VI; 6)
Bull. Hill. Mus. **4:** 178 (Hoey's Bridge, Kenya, ♀).

♀: fw. 27 mm. Wings strongly crenulate. Body and fw dark brown heavily marked with creamy-buff. Hw dark brown with a light spot at tornus.
GENITALIA: not dissected.
Only known from 2 females, both from the type locality: one, the type in the British Museum, the other in the Stoneham Museum, Kitale.

TEMNORA RADIATA (Karsch) 1893.
Octyton radiata Karsch *Ent. Nachr.* **18:** 116 (Bismarckburg, Togo, ♂). West Africa to Angola.

TEMNORA PLAGIATA Walker 1856.
List. Lep. Ins. B.M. **8:** 105 (Natal, ♂).
1856 *Panacra confusa* Walker *l.c.* **8:** 161 (Natal).
1875 *Aspledon dicanus* Boisduval *Spec. Gen. Lep. Het.* **1:** 304 (Natal).
1894 *Lophuron maculatum* Rothschild *Novit. zool.* **1:** 71 (Natal). A very variable species.

Ssp. *plagiata*.
South Africa only.

Ssp. *fuscata* R. & J. 1903. (VI; 2)
Novit. zool. **9** *suppl.* : 576 (Kikuyu Escarpment, ♀).

Slightly larger and darker than the typical race, but doubtfully valid. Rhodesian specimens are intermediate. Sexes alike. Fw. 21–23 mm. Apex of fw rather blunt, margin irregularly crenulate. Body snuff brown with a dark dorsal line on head and anterior part of thorax. Fw snuff brown, mottled and variegated with dark brown and with pale greyish brown. A large dark brown angular spot from vein 4 to costa, its inner margin near middle of costa. Two oblique broad dark bands from inner margin to vein 2 and a small blackish spot in cellule 3, near margin. Apical area paler. Hw snuff brown with a darker margin and a faint reddish submarginal band. Abdominal tufts of ♂ red.

♀ GENITALIA: 8th sternite produced proximad into a rounded median lobe. Vaginal plate large and lightly sclerotised, roughly triangular posteriorly, produced into a lobe on either side of ostium anteriorly. Colliculum long and narrow, sharply curved to the left distally. Ductus long and slender, pitted and coiled in a spiral. Bursa very long, slightly pitted, but not pleated. Signa absent.

HABITAT AND RANGE

Wooded habitats from Malawi to East and Central Kenya and S. Ethiopia, above 4,500 ft.

EAST AFRICAN RECORDS

KENYA	NM :	Kiganjo, Thomson's Falls, Aberdares, Nairobi.
	BM :	Kikuyu Escarpment (Type).
TANZANIA	NM :	Mufindi.
ZAMBIA	NM :	Abercorn.
ETHIOPIA	NM :	Adola, Neghelli.

Ssp. (? form) *trapezoidea* (Clark) 1935. (VI; 3)
Temnora trapezoidea Clark *Proc. New Engl. zool. Cl.* **15:** 30 (Karunga, Kisumu, ♀).

Ground colour of fw more uniform, costal spot smaller and more rounded. The specimen cited above from Thomson's Falls (a ♂), is exactly intermediate between *fuscata* and *trapezoidea;* a ♂ from Abercorn in the National Museum (not the one cited above) and a ♀ in the British Museum from "S. Kavirondo" agree precisely with Clark's figure; a ♀ from Bukoba (N.W. Tanzania) in the N.M. and one from Budongo (W. Uganda) in the B.M. are more extreme, with all the dark markings enlarged, (except the costal spot which is reduced) and of the same colour and with the light markings becoming somewhat reticulate, as in *T. radiata* Karsch. The genitalia of these insects agree perfectly with those of specimens from Nairobi, Malawi and Natal, suggesting that this may be a cline with *trapezoidea* somewhere near the middle of the series. However, the presence of both *fuscata* (a rather pale specimen approaching the nominate form) and of *trapezoidea* at Abercorn vitiates this conclusion, and it is possible that they are seasonal forms occuring in the western part of the specific range only. The precise status of these insects will have to be left in abeyance until more material is available from the entire range of the species.

TEMNORA SPIRITUS (Holland) 1893. (VI; 1)
Ocyton spiritus Holland *Ent. News* **4:** 339 (Kangwe, Ogowe, ♂).

♂: fw. 19–20 mm. Very similar to *T. plagiata*, but much paler, the ground colour being a pale buffish brown, sometimes with a green tinge, particularly in fresh specimens. The hw has always a darker marginal band. Costa of hw slightly lobed, abdominal tufts very pale buff.

♀: darker than ♂.
GENITALIA: post-vaginal plate very narrow, deeply incised behind ostium. Ante-vaginal plate lightly sclerotised, broad, posteriorly bi-lobed. Ostium very wide. Colliculum short, very wide, tapering slightly at ductus. Ductus long; bursa scarcely wider than ductus, sharply elbowed at base, forming with the ductus a structure shaped like a stocking. Bursa not pleated, nor pitted, and without signa.

HABITAT AND RANGE

Forests from Sierra Leone to the Congo, Uganda and west Kenya.

EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Fort Portal, Kalinzu, Katera, Entebbe, Budongo.
	K :	Kawanda.
	B :	Kabanyolo.

TEMNORA HOLLANDI Clark 1920. (VI. 4)
Proc. New. Engl. zool. Cl. **7:** 74 (Cameroons).

Sexes alike. Fw. 17–18 mm. Head and body light brown with a darker dorsal line single at first, double from base to tip of abdomen. Fw narrow, margin very irregular, deeply indented below apex and above tornus. Fw light brown, with a well defined dark brown triangle at costa, followed by a dark brown streak which reaches margin at end of vein 3. Basal and apical areas of the same colour; basal area almost umarked except at base, apical area lightly mottled with darker brown and pale greyish. A narrow whitish line separating distal edge of triangle from apical area. Hw uniform dark brown, paler at tornus. Abdominal tufts light brown.

♂ GENITALIA: uncus long and slender, heavily sclerotised apically. Gnathos almost as long, dorso-ventrally dilated before apex, slightly upcurved. Valve rather long, basally constricted, apically pointed; subdorsal ridge very slight. Harpe long and slender, apically upcurved. Aedeagus long and slender, abruptly bent at base. A narrow dentate longitudinal ridge, almost half the length of aedeagus, ending at apex. Vesica with a large subbasal area clothed in dense short bristles and armed apically with numerous minute spines.

♀ GENITALIA: 8th tergite sinuate posteriorly, with a well sclerotised mesial anterior lobe, broader apically than mesially. Post-vaginal plate a narrow transverse crescent. Ante-vaginal plate lacking. Colliculum slender, slightly sinuous, directed towards the left, with a slight emargination at the ostium. Ductus long and pleated. Bursa small, pleated, shaped like a sock, without signa.

RANGE AND HABITAT
Forests from Nigeria to the Congo and Uganda.
EAST AFRICAN RECORDS

UGANDA	BM :	Kamengo.
	B :	Entebbe.

TEMNORA RATTRAYI Rothschild 1904. (V; 26)
Novit. zool. **11:** 436 (Kampala, ♂).

♂: fw. 16 mm. Very similar to *T. hollandi*, but differs in having the basal area of fw darker and more variegated, the apical area paler and also more variegated and the costal triangle narrower and more oblique. Costa of hw slightly lobed, abdominal tufts pale pink.

♀: fw. 17–21 mm. Similar to ♂, but broader winged, generally darker and less variegated.
GENITALIA: vaginal plate very weak, almost membranous. Colliculum evenly wide, rather long, directed to the left. Ducuts extremely long and slender, pleated and pitted, spirally coiled. Bursa sock-shaped, covered in minute tubercles. Signa absent.

RANGE AND HABITAT
Forests in the Congo and Uganda.
EAST AFRICAN RECORDS

UGANDA	NM :	Katera, Entebbe.
	BM :	Kampala (Type).

TEMNORA ZANTUS (Herrich-Schaffer) 1854.
Lophura zantus Herrich-Schaffer *Ausser. Schmett.* **1,** t. 23, f.105 (Cape).
1856 *Enyo excisa* Walker *List. Lep. Ins. B.M.* **8:** 119 (Natal).
1875 *Aspledon dorus* Boisduval *Spec. Gen. Lep. Het.* **1:** 306 (Caffraria).
1928 *Temnora brunnescens* Clark *Proc. New Engl. zool. Cl.* **10:** 33 (Pondoland).

Ssp. *zantus*.
South Africa.

Ssp. *curvilimes* Hering 1927.
In Seitz, *Macrolepidoptera of the World* **14:** 375 (Mikindani,♀).

♂: fw. 18–19 mm. Body and wings very dark purplish-brown. Margin of fw very irregular and deeply indented. Fw very dark purplish-brown; a blackish line curved proximad from vein 4 to costa at $\frac{2}{3}$ from base. Apical area outside blackish line light olive-brown, mottled with darker olive and pale grey. A prominent black spot at costa immediately beyond blackish line. Hw very dark brown with an olive brown angular spot at tornus. Underside dark reddish-brown, abdominal tufts dark reddish brown.

♀: fw. 19–21 mm., broader winged, margin of fw less irregular.
GENITALIA: 8th tergite mesially sinuate at posterior margin. Postvaginal plate triangular, laterally incurved. Antevaginal plate in the form of a rather shallow Gothic arch. Ostium very wide. Colliculum narrow, long, curved to the left. Ductus exceptionally long and slender, pitted. Bursa very broad and blunt, decorated with minute circular depressions, particularly at the "heel" and at the apex. Signa lacking.

HABITAT AND RANGE
Forest and woodland from Rhodesia and Mozambique to Malawi, Tanzania and the Kenya coast.

EAST AFRICAN RECORDS

KENYA	NM :	Sekoke forest.
	S :	Mombasa.
TANZANIA	NM :	Amani, Ilonga.
	R :	Mbeya, Mlingano.
	MB :	Dar es Salaam, Mikindani.

Ssp. *apiciplaga* (Karsch) 1891. (VI; 5)
Pseudenyo apiciplaga Karsch *Ent. Nachr.* **17:** 291 (Cameroons).

Slightly larger than above (fw. 20–21 mm.). Ground colour more reddish, apical area paler, more ochreous, diagonal blackish band wider, underside more reddish, genitalia as in *curvilimes*.
RANGE: Cameroons to Uganda and W. Kenya.

EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Kayonza, Entebbe, Nagunga, Kabanyolo.
	BM :	Kamengo, Katera.
	SM :	Budongo.
	L :	Mweya.

TEMNORA WOLLASTONI R. & J. 1907.
Novit. zool. **15:** 260 (Upper Congo). Known from the Congo.

TEMNORA PYLAS (Cramer) 1779.
Sphinx pylas Cramer *Pap. exot.* **3:** 23 (Surinam).
1856 *Lophura brisaeus* Walker *List. Lep. Ins. B.M.* **8:** 106 (Surinam).
Type locality erroneously stated to be Surinam, in South America. Confined to South Africa and Rhodesia.

TEMNORA PYLADES R. & J. 1903.
Novit. zool. **9** *suppl.* : 583 (Natal, ♂).
1926 *Temnora stevensoni* Clark *Proc. New Engl. zool. Cl.* **9:** 52 (Rhodesia).

Ssp. *pylades*. (VI; 8)
South Africa to Rhodesia.

Ssp. *tanganyikae* Clark 1928.
Proc. New Engl. zool. Cl. **10:** 45 (Njawarongo, Ruanda river, Tanganyika, ♂).

Differs from the nominate race in the greyer colour of the fw and in the wider dark margin of the hw. Sexes alike. Fw. 17–20 mm. Body and fw brownish grey. Fw margin slightly dentate, projecting at end of vein 4. Fw rather pale brownish grey, with numerous, irregular transverse lines, and an ill-defined darker subapical fascia from vein 3 to the costa; apical area more strongly mottled with darker grey-brown. A small black submarginal lunule in cellule 2 in some specimens. Hw ochreous yellow, with a very broad, diffuse reddish grey marginal band. Underside brownish-grey, more reddish near base, with numerous crenulate, parallel transverse lines. Abdominal tufts of ♂ pale buff.

♀ GENITALIA: postvaginal plate narrow and short, with minute tubercles. Ante-vaginal plate membranous. Ostium wide. Colliculum wide, short and directed to the left. Ductus very long and slender. Bursa sock-shaped, slightly pitted apically, without signa.

HABITAT AND RANGE
Highland forest in East Africa.
EAST AFRICAN RECORDS

KENYA	NM	:	Ol Kalau, Thomson's Falls.
UGANDA	NM	:	Fort Portal.
TANZANIA	NM	:	Mbeya.
	BM	:	Njombe.
	ESB	:	Mt. Meru.

NOTE: *T. pylades* has the same genital armature as *T. pseudopylas* Rothschild in both sexes, and is considered a form of it by some authors, including Kernbach. However, this view is unlikely to be correct, as *pylades* has a much more restricted range and habitat than *pseudopylas*, and can always be separated from it by the following characters: Smaller, greyer on both sides, fw margin less indented, costa of hw only very slightly lobed.

TEMNORA PSEUDOPYLAS (Rothschild) 1894.
Lophuron pseudopylas Rothschild *Novit. zool.* **1:** 71 (patria incognita, ♂).
1936 *Temnora congoi* Clark *Proc. New Engl. zool. Cl.* **15:** 88 (Kafakumba, Katanga, Congo, ♂) syn. nov.

Ssp. *pseudopylas*. (VI; 7)
Sexes alike. Fw. 20–22 mm. Very similar to the previous species, but slightly larger, fw and body reddish brown to dark purplish brown, margin of wings more deeply indented. Markings of fw heavier, more distinct, dark margin of hw dark brown, better defined, underside variegated with ochreous yellow and orange brown, never greyish; costa of hw more strongly lobed. Abdominal tufts of ♂ dull reddish brown.
GENITALIA: as in *T. pylades* in both sexes.

EARLY STAGES: (after D. G. Sevastopulo).
5TH INSTAR: head and body green. A faint darker dorsal stripe and a subdorsal white stripe. 3rd and

4th somites with a slightly oblique interrupted yellow lateral stripe, edged with black on the third. A series of oblique white lateral stripes from 6th to 11th somites. Lateral and dorsal white stripes speckled with black and edged with black speckles. Green lateral areas sprinkled with white dots along the secondary segmental divisions. An elliptical white spot from base of horn to tip of anal flap. Horn lavender blue, minutely tuberculate, slightly downcurved, tip dark brown, ending in a sharp spine. Spiracles white, central slit black. Legs pink. Prolegs and venter green. Turns brown prior to pupation.

FOOD PLANTS: (Kenya coast) *Pentas bussei* Krause (Rubiaceae).

HABITAT AND RANGE

Very common and almost ubiquitous in eastern and southern Africa, but absent in very dry habitats; *congoi* Clark 1936 is a pale reddish ♂ from Katanga, which is closely matched by the Abercorn specimen in the National Museum; this is probably a very dry form.

EAST AFRICAN RECORDS

KENYA	NM :	Nairobi, Aberdares, Ruiru, Machakos, Nyeri, Nakuru, Nanyuki, Kakamega, Fort Hall, Kiganjo.
	SM :	Kitale, Istsare.
	S :	Mombasa.
UGANDA	NM :	Mubende, Fort Portal, Impenetrable forest, Kayonza.
	S :	Kampala.
	K :	Nagunga, Jeza.
TANZANIA	NM :	Amani.
	R :	Arusha, Ilonga, Mlingano.
	MC :	Lindi, Songea.
ETHIOPIA	NM :	Butale.

Uganda specimens are transitional to ssp. *leptis* R. & J.

Ssp. *leptis* (R. & J.) 1903 stat. nov.
Temnora leptis R. & J. *Novit. zool.* **9** *suppl. :* 548 (Sierra Leone, ♂).

Darker than the nominate race with a wider dark border to the hw. Specimens from the Congo and Uganda are intermediate between this race and the nominate race.

Ssp. *latimargo* R. & J. 1903.
Novit. zool. **9** *suppl. :* 584 (Grande Comore, ♂). Comoro Islands.

TEMNORA SCHEVENI sp. nov. (X; 4—XIV; 2)

Closely allied to *T. pseudopylas* Rothschild, but larger and very much darker.

MALE

ANTENNAE: long, slender, slightly thickened distally, sharply hooked, very dark purplish brown above, cilia rather long.

HEAD: frons Vandyke brown; vertex Vandyke brown, prominently crested; crest darker; palpi Vandyke brown, orange brown at base of 1st segment.

THORAX: Vandyke brown above; tegulae with a slight reddish tinge. Below, walnut brown laterally, ochraceous orange ventrally.

ABDOMEN: Vandyke brown above; a series of 2 subdorsal oblique dark reddish streaks on 3 penultimate segments; last segment dark reddish brown. Anal tuft very dark brown, almost black. Below walnut brown, mottled with ochraceous orange ventrally; 3 penultimate segments with 2 small whitish lateral dots.

LEGS: Vandyke brown; femora of mid-pair with an orange brown tinge, tips of tibial spurs paler.

UPPERSIDE

FOREWING: apex not produced; margin produced at vein 7, then incurved to vein 4, and regularly indented between the veins to tornus; end of veins 6 and 5 rather prominent; length of fw 22–23 mm; wing broader than in *T. pseudopylas*. Ground colour very dark Vandyke brown with a violetish sheen; basal line very faint, blackish, subbasal very dark reddish brown, faint, double, irregular; ante-medial very dark reddish brown, better defined, double, somewhat irregular and curved distad, filled in at the costa to form a dark spot. Stigma very small, pinkish; four faint slender dark lines strongly angled proximad between the veins from the inner margin to vein 4. A very dark reddish brown irregular spot from costa at $\frac{2}{3}$ from base to vein 4 with an extension distad, parallel to costa from vein 6 to vein 5, not invading submarginal area, streaked with black along the veins. A dark reddish brown submarginal spot in space 7, reaching costa near apex followed by a narrow fascia to vein 4, coalescing with the large dark irregular spot in space 6. Submarginal portion of space 3 mottled with paler reddish brown and with a few black and pinkish scales. A black sagittate spot surrounded proximally with reddish brown near termen in space 2. Terminal line black, dilated into a small sagittate spot in space 7, rather thick from vein 7 to vein 3, thence narrow, but dilated at the veins. Cilia black, apically buff between the veins.

HINDWING: regularly dentated between the veins, slightly produced at tornus, lobed at costa. Basal third yellow ochre, remainder dark bister brown, the dividing line between the two colours, very irregular. A faint paler submarginal line showing through from underside. Termen narrowly black, dilated at the veins, cilia as above.

UNDERSIDE

FOREWING: Prout's brown, with complete submarginal series of irregular internervular ochraceous-orange spots.

HINDWING: rusty brown at costa, shading to ochraceous-orange towards inner margin and tornus. A faint reddish brown ante-medial line from lower angle of discoidal cell to middle of cellule la. Postmedial double, blackish near costa, becoming reddish brown, strongly dentate distad at the veins, the intervening space with scattered rusty scales. An irregular Vandyke brown marginal band from apex to vein lb.

GENITALIA: of the usual *Temnora* pattern and very similar to *T. pseudopylas* Rothschild. Uncus slender, evenly curved, heavily sclerotised apically. Gnathos almost as long, heavily sclerotised and irregularly dentate. Valve rather long and slender; subdorsal ridge well developed, modified scales very large, protruding beyond dorsal margin of valve. Harpe broad basally, tapering rapidly to a rather long, slender, somewhat irregular process, upcurved at the apex. Saccus of the usual pattern, broad and rounded. Aedeagus rather long; dorso-apical margin broadly rounded and smooth, produced on the right side into a narrow oblique dentate ridge and on the left side into a long narrow oblique process with 2 subapical notches. Vesica armed with numerous spicules, much shorter than in *T. pseudopylas*.

FEMALE: unknown.

HOLOTYPE ♂: Kalinzu forest, Ankole, Uganda, III–1965, B. Scheven, to be deposited in the British Museum (Natural History).

♂ PARATYPES: 4 same data as *Holotype*

2 as above, but April 1965.

Paratypes in National Museum, Nairobi.

This species is dedicated to its discoverer, Dr. B. Scheven.

Temnora aureata Karsch and *T. stigma* R. & J. were erroneously placed in this genus and belong to the tribe Choerocampini; see pages 117 and 127.

PSEUDENYO Hollandi 1889

Trans. Amer. ent. Soc. **16:** 57; type species *Pseudenyo benitensis* Holland 1889.

PSEUDENYO BENITENSIS Holland 1889.
Trans. Amer. ent. Soc. **16:** 57 (Benita, Gabon, ♂). Nigeria to Gabon and Spanish Guinea.

TEMNORIPAIS R. & J. 1903

Novit. zool. **9** *suppl.* : 585; type species *Pterogon lasti* Rothschild 1894.

TEMNORIPAIS LASTI (Rothschild) 1894.
Pterogon lasti Rothschild *Nov. zool.* **1:** 70 (S.W. Madagascar, ♂). Madagascar only.

HYPAEDALIA Butler 1877

Trans. ent. Soc. Lond. : 397; type species *Hypaedalia insignis* Butler 1877.

Three medium sized, heavy-bodied species, all African. Palpus laterally angular, end segment apically triangular, upcurved, projecting well in front of eye, completely scaled internally. Antennae compressed and not clubbed in both sexes, last segment short. Eyes rather small, ciliated. Vertex with a very prominent crest directed forward, expanded on thorax to form a large dorsal patch of woolly hair-scales. Abdomen broad and flattened, spines weak. Abdominal tuft broad and rounded in ♂, narrow in ♀. Tibial spurs very unequal. Wings broad and short; fw slightly incurved below apex, hw costa convex, protruding beyond costa of fw and thus effectively breaking up outline of insect when resting. Vein 9 of fw arises from cell at $\frac{1}{3}$ from apex, vein 8 just before apex; upper angle of dc acute, lower one a right angle. Dc just under half the length of wing, and narrow. DC of hw short and narrow, veins 6 and 7 on a short stalk, costal area above vein 8 very broad. ♂ genitalia very much as in *Temnora*, but modified scales smaller, and more numerous, not arranged in a single straight line. Aedeagus with a bifid apical process as in *Nephele*, Vesica unarmed. Crepuscular forest insects.

HYPAEDALIA INSIGNIS Butler 1877.
Trans. ent. Soc. Lond. : 398 (Sierra Leone, ♀). Sierra Leone to Gabon.

HYPAEDALIA LOBIPENNIS Strand 1913.
Arch. Naturgesch. **79** A*:* 83 (Cameroons). West Africa.

HYPAEDALIA BUTLERI Rothschild 1894. (VI; 9—XIV; 4,9)
Novit. zool. **1:** 69 (Aburi, Gold Coast, ♀).
1936 *Temnora viridis* Clark *Proc. New Engl. zool. Cl.* **15:** 86 (Congo) syn. nov.

Sexes alike. Fw 25–27 mm. Head and thorax purplish brown. A large patch of raised olive green hairs edged with dark brown on head and thorax; abdomen pale ochreous brown. Fw purplish brown with irregular narrow dark brown transverse lines, and a minute dark stigma; a broad well defined, very irregular dark purple brown marginal band, very narrow at apex, very wide at vein 4, then narrowing suddenly to tornus. Hw very short, uniform dark brown.

♀ GENITALIA: post-vaginal plate sub-triangular. Ante-vaginal plate consisting of two irregular lateral plates, one on either side of ostium. Colliculum short and wide, directed to the right. Ductus wide and very short. Bursa large, elongated and pitted. Signum longitudinally very long, from base of bursa, to a point $\frac{1}{4}$ of length of bursa from the apex, consisting of two parallel spinose ridges, very much as in *Nephele*.

HABITAT AND RANGE
Forests from Sierra Leone to the Congo and Uganda.
EAST AFRICAN RECORDS
UGANDA NM : Kamengo, Entebbe, Budongo, Katera.
BM : Nagunga, Kampala.

NEPHELE Hubner 1822

Verz. bek. Schmett. : 133; type species *Zonilia morpheus* Cramer 1777=*Sphinx didyma* Fabricius (India), 1775.

A very uniform genus of large dull coloured insects, 1 Australian, 1 Oriental species and 18 Ethiopian species. A conspicuous patch of fine hairs at base of proboscis, below pilifer. Palpi projecting well beyond frons, fully scaled internally. Eyes large, cilia absent. Antennae long, hooked, not clubbed in ♂, more slender, slightly incrassate distally in ♀; end segment long, rough scaled. Head not crested. Abdominal spines numerous, elongate, flattened, strong. Anal tuft 3-cornered in ♂, truncate in ♀. Mid and hindtarsi armed posteriorly with a comb of spines; tibial spurs very unequal; external (short) spur of midtibia and external apical spur of hindtibia also armed with a posterior comb of spines. Wing margins regular, entire; lower angle of discoidal cell obtuse in fw. DC of hw very small, with lower angle strongly produced. Veins 6 and 7 with common origin, but not stalked. Genitalia of ♂ extremely uniform throughout the genus, typically Semanophorine; uncus simple, slender, with a small terminal hook; gnathos short and narrow, without terminal hook or teeth. Saccus rounded, broad. Valve entire, with a hairless subdorsal area, sometimes less heavily sclerotised than remainder; dorsal margin of valve thickened in some species. Modified scales long and much narrower than in *Temnora*, without "midrib", heavily sclerotised throughout, in one or two rows, and more numerous than in *Temnora*. Harpe terminating in a sharp upcurved hook. Aedeagus armed apically with a bifid dorsal process, as in *Hypaedalia;* vesica unarmed. ♀ genitalia also very uniform, ante-vaginal plate absent, post vaginal plate very small, triangular. Colliculum long and slender, bursa long, signum a very long, narrow longitudinal plate. Larva with thoracic segments only slightly smaller than remainder, head large and round, horn very short and stumpy. Pupa with proboscis sheath projecting well beyond head, laterally compressed.

All species of *Nephele* feed readily on flowers at dusk and during the night. Both sexes appear to be on the wing at the same time and are attracted to light in equal numbers.

NEPHELE XYLINA R. & J. 1910. (VI; 13—XIV; 7)
Novit. zool. **17**: 457 (Abyssinia, ♂).
1916 *Nephele vespera* Fawcett *Proc. zool. Soc. Lond.* : 108 (Kedai, B.E.A. ♂).

Sexes alike. Fw 30–33 mm. Antennae of ♂ thicker than in other species of the genus. Body and fw pale greyish olive to pale greyish buff, abdomen completely unmarked. Apex of fw blunter than in other species, termen more rounded. Fw with a number of diffuse irregular transverse lines, and a very small pale stigma. Hw uniform grey, paler at base.

HABITAT AND RANGE

Semi-desert from Kenya to Ethiopia and Somalia.

EAST AFRICAN RECORDS

KENYA	BM :	Kedai.
ETHIOPIA	NM :	Dire Dawa.
	BM :	Harar.
SOMALIA	NM :	Hargeisa.
	BM :	Buran.

NEPHELE LEIGHI Joicey & Talbot 1921.
Entomologist **54:** 107 (Mahe Island, Seychelles, ♀). Seychelle Islands only.

NEPHELE AEQUIVALENS (Walker) 1856. (VI; 20)
Pachylia aequivalens Walker *List. Lep. Ins. B.M.* **8:** 191 (Sierra Leone, ♀).
1875 *Zonilia zebu* Boisduval *Spec. Gen. Lep. Het.* **1:** 148 (Sierra Leone).

The largest species in the genus.
Sexes alike. Fw 45–52 mm. Body and wings dark greyish olive, abdomen unmarked. Fw with a thick straight dark diagonal line from tornus to middle of costa. Basal, subbasal, antemedial and postmedial lines faint, irregular and incomplete; submarginal complete, more regular and more distinct. Hw very dark olive, apical third darker.

HABITAT AND RANGE

Forest up to 5,000 ft. and heavy woodland throughout tropical Africa.

EAST AFRICAN RECORDS

KENYA	NM :	Kitale.
	S :	Mombasa.
UGANDA	NM :	Kampala, Bwamba, Fort Portal, Budongo.
	B :	Entebbe, Nakawa, Nyabyeya.
	BM :	Jinja.
	L :	Mweya.
TANZANIA	NM :	Amani, Ilonga.
	BM :	Moshi.
	R :	Mlingano, Dar es Salaam.
	MC :	Lindi, Songea.

NEPHELE COMMA Hopffer 1857. (VI; 15)
Monatsber. Ak. Wiss. Berlin : 421 (Mozambique).
1856 *Zonilia viridescens* Walker *List. Lep. Ins. B.M.* **8:** 192 (partim).
1877 *Nephele charoba* Kirby *Trans. ent. Soc. Lond.* : 239 (Madagascar).

Sexes alike. Fw. 32–39 mm. Very variable. Body and fw dark olive green to reddish-brown, to light ochreous-brown. Dorsum of abdomen broadly of the same colour as thorax, three large quadrate blackish lateral spots on segments 3, 4 and 5. Fw with irregular dark transverse bands which are usually much better developed in the olive or ochreous specimens than in the reddish ones. Terminal area with a greyish tinge, usually in distinct contrast with remainder of wing, clearly defined proximally by a regular blackish submarginal line from apex to tornus; the marginal area is very wide at vein 5, tapering gradually and regularly from there to the apex and to the tornus. In the typical form (*comma* Hopffer), the stigma is a prominent silvery white reversed comma with its curve towards the base

of the wing and its extremities towards the termen. This stigma is even more dilated posteriorly and reduced anteriorly in form *charoba* Kirby, and is reduced to a tiny dot or altogether absent in form *derasa* R. & J. *Novit. zool.* **9** *suppl.* : 556 (=*Nephele charoba* form *microstigma* Clark, *Proc. New Engl. zool. Cl.* **9**: 108, 1927). Hw various shades of olive, with a darker margin.

HABITAT AND RANGE

Extremely common throughout the Ethiopian Region, including Madagascar.

EAST AFRICAN RECORDS

KENYA	NM :	Mtito Andei.
	SM :	Kitale, Istsare.
UGANDA	NM :	Katera, Kamengo.
	SM :	Tororo.
	L :	Mweya.
TANZANIA	NM :	Amani, Shinyanga, Mpanda.
	R :	Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Arusha, Ukiriguru.
	SM :	Mwanza.
	MC :	Lindi, Songea.
ETHIOPIA	GM :	Shoa.

NEPHELE FUNEBRIS (Fabricius) 1793. (VI; 11)

Sphinx funebris Fabricius *Ent. Syst.* **3,** 1: 371 (Guinea).

1856 *Zonilia viridescens* Walker *List. Lep. Ins. B.M.* **8**: 192 (Natal).

1877 *Nephele infernalis* Kirby *Trans. ent. Soc. Lond.* : 239 (Ashanti).

Sexes alike. Fw. 33–39 mm. Very similar to previous species, but less variable in colour, being usually some shade of dark olive brown. May be separated from *N. comma* by the presence of 5 large blackish lateral spots on the abdomen, and by the much more irregular margin of the terminal area of the fw, which does not contrast in colour with the remainder of the wing. The typical form has no stigma, or at most a minute whitish dot. Form *conimacula* R. & J. (*Novit. zool.* **9** *suppl.* : 558), has a silvery white stigma in the shape of a longitudinal wedge-shaped spot with the pointed end distad, sometimes surmounted proximally by a much smaller elongated spot.

EARLY STAGES: (after D. G. Sevastopoulo).

5TH INSTAR: head red-brown. Body red-brown, minutely streaked with black. Black dorsal line diffuse and interrupted after segment 5. An oblique elliptical lateral mark on 6 and 7, white, reticulated with reddish. A dark dorso-lateral line from 7th somite to base of horn. A pale pinkish lateral triangle, its apex at the anterior edge of 11th somite edged above by the dorso-lateral line and extending to anal clasper below. Spiracles black. Venter, legs and prolegs red-brown. Horn purplish-pink, stout, short, slightly downcurved, terminating in an abrupt conical point.

PUPA: in a slight web among litter on the surface of the soil. Reddish chestnut, minutely pitted. A blackish dorsal spot on head and a blackish dorsal line from mesothorax to anal end. A dark lateral suffusion and a broad dark ventro-lateral stripe on abdomen. Sheaths of antennae, legs and wings minutely chequered with greyish. A black line along proboscis sheath, which is produced frontad, rather as in *N. comma*. Spiracles black, Cremaster deeply grooved ventrally, ending in a short bifid spine.

HABITAT AND RANGE

Very common throughout most of the Ethiopian Region, excluding Madagascar and the Congo-Cameroon equatorial forest belt, where it is replaced by *N. maculosa* R. & J.

EAST AFRICAN RECORDS

KENYA	NM :	Kitale, Aberdares, Sokoke forest.
	SM :	Mombasa, Malindi, Mambrui, Shimo la Tewa.
UGANDA	NM :	Kamengo, Budongo, Entebbe.
	SM :	Katera.
	B :	Kampala.
	L :	Mweya.
TANZANIA	NM :	Amani.
	R :	Arusha, Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea.
SOMALIA	NM :	Mogadishu.

NEPHELE MACULOSA (R. & J.) 1903 stat. nov.
Nephele funebris maculosa R. & J. *Novit. zool.* **9** *suppl.* : 558 (Yakusu, Upper Congo, ♂).

Very similar to previous species, but larger and more variegated. Only known from the Congo-Cameroon equatorial forest belt, where it appears to replace the previous species. Will almost certainly be found in the Bwamba Valley of western Uganda.

NEPHELE DISCIFERA (Karsch) 1891. (VI; 12)
Nephele peneus (Cramer), form *discifera* Karsch *Ent. Nachr.* **17:** 298 (Cameroons).
1894 *Nephele aureomaculata* Rothschild *Novit. zool.* **1:** 88 (Upper Congo).
Sexes alike. Fw. 32–36 mm. Very similar to *N. comma*, but always very dark olive brown, all abdominal segments marked laterally with black, stigma minute, wings broader and more rounded. Marginal area of fw as in *comma*, but constrasting with remainder of wing even more strongly. The typical form has a large rounded orange-pink spot at middle of inner margin of fw. Form *rattrayi* Rothschild 1904 (*Novit. zool.* **11:** 437), has the pink spot reduced or completely lacking.

HABITAT AND RANGE
Forests from Liberia and Ghana to the Congo and Uganda.
EAST AFRICAN RECORDS

UGANDA	NM :	Masaka, Kamengo, Budongo.
	BM :	Jinja, Nagunga, Kampala.

NEPHELE LANNINI Jordan 1926. (VI; 18)
Novit. zool. **33:** 381 (Umtali, S. Rhodesia).

Sexes alike. Fw. 31–33 mm. Head, thorax and fw very dark olive brown. Abdomen with all segments marked with black, the black lateral spots almost meeting on the dorsum, where they are separated by a small dark olive spot, and separated longitudinally by almost uninterrupted pale buffish brown transverse stripes at the posterior margin of each tergite. Fw very broad and rounded, apex acute and very slightly falcate, mottled with blackish and with a faint diffuse black bar from middle of costa to tornus; a conspicuous irregular, interrupted submarginal pale grey line, edged proximally with black. Hw uniformly dark brown.

HABITAT AND RANGE
Highland forest in Rhodesia, Malawi, and southern Tanzania.
EAST AFRICAN RECORDS
TANZANIA NM : Mufindi.

NEPHELE MONOSTIGMA Clark 1925. (VI; 10)
Proc. New Engl. zool. Cl. **9:** 35 (Cameroons).

Sexes alike. Fw. 30–32 mm. Very similar to previous species, but slightly smaller, wings narrower, fw more mottled with ochreous brown, a very small white stigma usually present, submarginal line not edged distally with pale grey.

HABITAT AND RANGE
Highland forest in the Cameroons, Uganda and Kenya.
EAST AFRICAN RECORDS

UGANDA	NM :	Kibale forest, Kalinzu forest, Kayonza.
KENYA	NM :	Muguga, Kitale.

NEPHELE BIPARTITA Butler 1878. (VI; 14)
Ann. Mag. nat. Hist. (5) **2:** 455 (Old Calabar, Nigeria).

Sexes alike. Fw. 34–38 mm. Very similar to previous species; olive dorsal spots of abdomen larger, black lateral spots not separated by brownish buff, but by the ground colour; fw not falcate, ground colour pale yellowish olive, area beyond dark diagonal bar dark brown except at costa and apex, stigma absent. Hw dark olive brown, darker at apex and termen.

EARLY STAGES: (after D. G. Sevastopoulo).
5TH INSTAR: head purple brown, densely speckled with pale dots, a darker mark shaped like an inverted V with apex at vertex. Body dark brown, a black dorsal line edged indistinctly with pinkish on first 4 somites. A broad pinkish brown dorsal stripe from 7th somite, edged with black and containing a pattern of brown and pinkish markings repeated on each somite. Lateral area dark chocolate with a small copper-red sublateral patch on 4 and 5 and a broad oblique copper-red band on 6 and 7. From middle of 7th somite to middle of 9th whitish with two oblique brown lines edged below with copper-red. Latero-anal triangle pinkish brown speckled with dark brown. Spiracles slate-blue, set in copper-red spots. Horn short, downcurved, dull purplish, tuberculate, ending in a sharp point. Venter, prolegs and legs as above.
FOOD PLANT: *Landolphia* sp. (Apocynaceae).

HABITAT AND RANGE
Lowland forest and heavy woodland from West Africa to the coast of Kenya and Tanzania and to Malawi and Mozambique.
EAST AFRICAN RECORDS

KENYA	NM :	Gazı.
	SM :	Malindi, Istsare.
	S :	Mombasa.
	BM :	Kibwezi.
UGANDA	NM :	Bwamba.
	BM :	Entebbe, Jinja, Kamengo.
	L :	Mweya.
TANZANIA	NM :	Amani, Ukerewe.
	R :	Dar es Salaam, Ilonga, Mlingano.
	BM :	Mikindani, Kilosa, Ngudo, Uluguru.
	MC :	Lindi, Songea.

NEPHELE PENEUS (Cramer) 1776. (VI; 17)
Sphinx peneus Cramer *Pap. exot.* **1:** 139 (Sierra Leone).
1892 *Nephele pachyderma* Karsch *Ent. Nachr.* **18:** 180 (Baliburg).

Sexes alike. Fw. 33–40 mm. All abdominal segments marked with broad blackish spots separated by a pale brownish buff band at the posterior margin; olive dorsal spots rather wide. Fw broad, with evenly rounded termen, olive grey, banded and mottled with blackish and sometimes ochreous. Submarginal band very irregular, indistinct. Silvery white stigma consisting of a small anterior comma and of a wide angled V; in some specimens the arms of the V do not meet at the apex and the stigma then consists of 3 spots. Occasional specimens without the stigma are referable to the form *innotata* R. & J., *Novit. zool.* 9 *suppl.* : 560.

EARLY STAGES: (after D. G. Sevastopulo).
4TH INSTAR: head olive, a darker line on each cheek with a paler one behind it. Body olive-green. Somites 1 to 4 with a fine blackish dorsal line and a dark subdorsal line. Dorsum behind somite 6 heavily suffused with whitish with a series of X shaped olive marks. An oblique white lateral streak on somite 6. A subdorsal white line from 7 to base of horn, edged below with a fine white line expanded into a lateral triangle on 11. Lateral area from 7 to 10 with a reticulate pattern of dark lines. Somites 5 and 6 with paired white dorsal spots. Legs, prolegs and venter very dark olive. Horn long, olive, apically upturned and white. Thorax expanded into a lateral lobe at 4 and 5.
5TH INSTAR: similar to above, but with less contrast between dorsal and lateral areas. Horn shorter and stouter, olive with dark speckles laterally and below, tip truncate.

PUPA: in slight cocoon in surface litter. Dark dull chestnut, with a blackish dorsal line. Dorsum of abdomen heavily speckled with black, remainder less so. A black ventral line. Proboscis sheath prominent, shaped like a duck's bill. Cremaster black, ending in two slightly downcurved stout spines.
FOOD PLANT: an unidentified Asclepiadaceous creeper.

HABITAT AND RANGE
Forest and woodland from Senegal to East Africa, Angola and Delagoa Bay.

EAST AFRICAN RECORDS

KENYA	NM :	Voi, Tiwi, Mtwapa, Kibwezi.
	SM :	Shimo la Tewa.
	S :	Mombasa.
	BM :	Kiokwe.
UGANDA	NM :	Bwamba, Budongo.
	BM :	Masindi.
	B :	Nakawa.
	L :	Mweya.
TANZANIA	NM :	Amani, Mufindi.
	R :	Dar es Salaam, Mlingano, Tabora, Ilonga.
	BM :	Mikindani, Moshi, Pemba, Kilwa.
	MC :	Lindi, Songea.
SUDAN	BM :	Tambura, Bahr el Ghazal.
ETHIOPIA	NM :	Bongozi (lower Omo River).

NEPHELE ACCENTIFERA (Beauvois) 1805.
Sphinx accentifera Beauvois *Ins. Afr. Amer.* : 264 (Africa).
1840 *Sphinx tridyma* Hoeven *Tijdschr. Naturl. Gesch.* **7:** 278 (Guinea).
1850 *Deilephila ranzani* Bertoloni *Mem. Ac. Bologna* **2:** 183 (Mozambique).
1875 *Nephele variegata* Butler *Proc. zool. Soc. Lond.* : 15 (Congo).

Ssp. *accentifera*. (VI; 19)

Sexes alike. Fw. 35–42 mm. Abdomen heavily marked with black as in previous species. Fw broad, with evenly curved margin, boldly but irregularly marked with dark brown, grey and ochreous. Submarginal areas dark brown with diffuse ochreous internervular spots at the termen. A very dark wedge shaped area with apex at inner margin, near base. A large ochreous apical area at costa, and a similar but smaller spot between costa and stigma. Stigma consisting of 3 silvery white commas converging rather like the spokes of a wheel. Hw dark olive brown with a blackish margin.

HABITAT AND RANGE

Common in most habitats throughout the Ethiopian Region, excluding Madagascar and the Cape.

EAST AFRICAN RECORDS

KENYA	NM	:	Kibwezi, Nairobi, Kiganjo, Aberdares, Kitale.
UGANDA	NM	:	Kampala, Masaka, Bwamba.
	SM	:	Budongo, Nabugabo, Bombo.
	B	:	Chobe, Entebbe, Nyabyeya.
TANZANIA	NM	:	Amani, Mufindi.
	R	:	Arusha, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC	:	Lindi, Songea.
ERITREA	BE	:	Dorfu.
ETHIOPIA	NM	:	Bongozi (lower Omo River).

Ssp. *comoroana* Clark 1923.
Proc. New Engl. zool. Cl. **8:** 61.
Comoro Islands,

NEPHELE VAU (Walker) 1856. (VI; 16)
Zonilia vau Walker *List. Lep. ins. B.M.* **8:** 197 (patria incognita).
1857 *Zonilia schimperi* Lucas *Ann. Soc. ent. France:* 605 (Abyssinia).
1878 *Zonilia raffrayi* Oberthür *Et. d'Ent.* **3:** 31 (Abyssinia).

Sexes alike. Fw. 25–31 mm. Black abdominal spots somewhat diffuse and narrow. Ground colour variable, from pale greyish buff to coppery-brown, to olive-green. Fw with a large dark olive to reddish brown, to olive-green. Fw with a large dark olive to reddish-brown subtriangular spot with apex at tornus and base resting from middle of costa to apex, with distal margin well defined but very strongly indented. A V-shaped golden-white stigma. Hw olive bordered with brown or copper.

HABITAT AND RANGE

Common throughout most of Africa south of the Sahara, but rarer in southern Africa.

EAST AFRICAN RECORDS

KENYA	NM	:	Nyeri, Nairobi, Voi, Aberdares, Thomson's Falls, Machakos.
	SM	:	Istsare, Kitale.
	S	:	Mombasa.
UGANDA	NM	:	Budongo.
	B	:	Nakawa.
	L	:	Mweya.
TANZANIA	NM	:	Arusha, Ukerewe, Mufindi.
	R	:	Mlingano.
	MC	:	Lindi, Songea.
ERITREA	MG	:	"Eritrea".

NEPHELE DENSOI (Keferstein) 1870.
Zonilia densoi Keferstein *Jahrb. Ak. Erfurt* (2) **6:** 14 (Madagascar).
1864 *Zonilia rhadama* Walker *List. Lep. Ins. B.M.* **8:** 33 (nomen nudum).
1874 *Zonilia malgassica* Felder *Reise Novara. Lep.* pl. 74, f. 2 (Madagascar).
Madagascar and Comoro Islands.

NEPHELE ARGENTIFERA (Walker) 1856. (VII; 4)
Zonilia argentifera Walker *List. Lep. Ins. B.M.* **8:** 194 (Natal).

Sexes alike. Fw. 32–35 mm. Black lateral spots of abdomen large and well defined. Ground colour of body and fw dark olive, usually fading to light ochreous brown. Fw with a a straight silvery-white subbasal band and a thick silvery-white postmedial with proximal margin evenly curved, distal margin straight. Stigma consisting of a large silvery-white triangular spot. Hw olive with a wide blackish margin.

HABITAT AND RANGE
Coastal bush and savanna from Somalia to Natal.

EAST AFRICAN RECORDS

KENYA	NM	:	Tiwi, Mtwapa, Meru.
	SM	:	Mombasa, Malindi.
	BM	:	? Nairobi.
TANZANIA	NM	:	Amani, Dar es Salaam.
	R	:	Ilonga, Mlingano.
	R. J.	:	Kilwa, Lindi.
	MC	:	Songea.
SOMALIA	BE	:	Lower Shebeli.

NEPHELE OENOPION (Hübner) 1806.
Orneus oenopion Hübner *Samml. ex. Schm.* **2:** 159 (patria incognita).
Ssp. *oenopion.*
Nephele oenipion oenopion R. & J. *Novit. zool.* **9** *suppl.* :562 Madagascar, Bourbon, Mauritius.

Ssp. *stictica* R. & J. 1903.
Novit. zool. **9** *suppl.* : 562 (Grande Comore, ♂).
Comoro Islands.

Ssp. *continentis* R. & J. 1903. (VII; 3)
Novit. zool. **9** *suppl.* :562 (Sierra Leone, ♂).

Sexes alike. Fw. 38–40 mm. Black abdominal spots rather diffuse and narrow. Ground colour of body and fw dark olive-brown, sometimes fading to dark red-brown. Fw with a small white basal dot, an irregular paler olive subbasal band edged with white, and an almost straight postmedial consisting of a thick white proximal line slightly curved distad near inner margin and of a narrower straight white distal line. Stigma absent or indicated by a minute white dot, subbasal and postmedial parallel, not converging at inner margin as in *N. argentifera.* Marginal area paler, limited by an irregular, interrupted, faint dark line from apex to tornus, strongly incurved proximad at vein 5, where it almost meets outer white line. Hw dark olive with a broad blackish outer margin.

HABITAT AND RANGE
Forests from Sierra Leone to the Congo and East Africa.

EAST AFRICAN RECORDS

KENYA	S :	Mombasa.
UGANDA	NM :	Budongo, Kamengo.
	B :	Nyabyeya.
	L :	Mweya.
TANZANIA	NM :	Amani.

NEPHELE ROSAE Butler 1875.
Proc. zool. Soc. Lond. : 14 (Boma, ♂).

Ssp. *rosae.*
Sexes alike. Fw. 40–45 mm. Very similar to previous species, but larger and differing as follows: subbasal band wider, without white edges; stigma present, in the form of a small white comma; postmedial band proximally straight, and edged with white, distal border without white edging; marginal area as in *N. oenopion*, but even more irregular and more contrasting with ground colour, hw blackish with an olive suffusion at base.

HABITAT AND RANGE
Forest and woodland from Sierra Leone to Angola and Uganda.
EAST AFRICAN RECORDS

UGANDA	NM :	Katera, Budongo.
	B :	Mpanga, Nakawa.
	L :	Mweya.

Ssp. *illustris* Jordan 1920. (VII; 2)
Novit. zool. **27:** 512 (Inyamadzi, Mozambique, ♀).

Larger than the typical race (fw. 44–48 mm.). Differs also in lacking the stigma and in having a much broader white proximal margin to the postmedial band.

EARLY STAGES: (after D. G. Sevastopulo).
LARVA (FINAL INSTAR): head green with a pale stripe from vertex to outside the mouth, edged internally by a darker stripe Body green with a purplish dorsal line wider posteriorly. A broad white lateral stripe from subventral area of somite 6 to sublateral area of 7. Similar, but less prominent lines on 7/8 and 8/9. A lateral white line from somite 9, dividing at 11 to form a broad white horizontal V. Horn purplish, stout, tuberculate, downcurved at first, but the tip pointed and upcurved. Legs blackish, set in yellow patches. Venter and prolegs green. Spiracles black, the ends white. 6th somite slightly expanded laterally. When alarmed, the head and first two somites are retracted, the yellow patches in which the legs are set producing a yellow streak on each side of the head.

PUPA: in slight web among surface litter. Olive-brown with a blackish dorsal line. Lateral area blackish contrasting strongly with the pale venter. Proboscis sheath a short "duck's bill". Cremaster rounded, mesially concave armed with six teeth which are continued ventrally as a double ridge.

RANGE AND HABITAT
Transvaal and Mozambique to Rhodesia, Zambia, Malawi, Tanzania and the Kenya coast.
EAST AFRICAN RECORDS

KENYA	NM :	Gazi Forest.
	S :	Shimba Hills.
TANZANIA	NM :	Amani.
	BM :	Pemba, Nguelo.
	R :	Ilonga, Mlingano, Mbeya.
	MC :	Lindi, Songea.

NEPHELE RECTANGULATA Rothschild 1894. (VII; 1)
Iris. **7:** 300 (Sierra Leone, ♂).

Sexes alike. Fw. 36–40 mm. A complete series of large lateral black spots on abdomen. Ground colour of thorax and fw rich olive-brown. Fw with a straight silvery-white line from costa at almost $\frac{1}{2}$ from base to tornus, where it meets a straight silvery-white submarginal line, forming a right angle. Hw uniform dark brownish-red.

HABITAT AND RANGE
Forests from Sierra Leone to the Congo and Uganda.
EAST AFRICAN RECORDS

UGANDA	NM :	Budongo, Kampala, Entebbe, Kabanyolo.
	BM :	Katera, Masaka, Kawanda.

MAASSENIA Saalmüller 1884

Lep. Madag. : 126; type species *Zonilia heydeni* Saalmüller, 1878.

MAASSENIA HEYDENI (Saalmüller) 1878.
Zonilia heydeni Saalmüller *Ber. Senk. Nat. Ges.:* 89 Madagascar only.

DEILEPHILA Laspeyres 1809

Jenaische Allg. Literatur-Z. **4:** 99; type species *Sphinx nerii* L. 1758.
1815 *Elpenor* Oken *Lehrb. Nat.* III, **1:** 760; type species *S. nerii* L.
1823 *Daphnis* Hübner *Verz. bek. Schm. :* 134; type species *S. nerii* L. (partim).
1835 *Choerocampa duponcheli* in God. *Lep. France Suppl.* **2** 159; type species *S. nerii* L.
1836 *Metopsilus* Duncan, in Jardine, *Nat. Libr.* **40:** 154; type species *Sphinx nerii* L.

Large species. Palpi rather prominent. Antennae slender, of uniform thickness in the ♂, slightly clubbed in the ♀, abruptly hooked, last segment prolonged into a long filiform process. Eyes large, without cilia. Abdominal spines long, but rather weak. Tarsi spinose, midtarsus with posterior comb of spines. Tibial spurs very unequal, without comb of spines. Wing margins entire. Discoidal cell of fw narrow, slightly shorter than half of costa. Vein 10 arises from radius at $\frac{1}{3}$ of length of cell before end of cell. Vein 9 arises before end of cell. Discoidal cell of hw very short and narrow, lower angle produced; veins 6 and 7 on a short stalk. Genitalia very much as in *Nephele*, but modified scales of ♂ larger, only slightly sclerotised. Larva tapering anteriorly, pupa with proboscis sheath laterally compressed, but not projecting frontad.

One Indo-Afro-Palaearctic species, 3 Australian species, 2 Oriental species and 1 Indo-Australian.

DEILEPHILA NERII (Linnaeus) 1758.
Sphinx nerii Linnaeus *Syst. Nat.* **10:** 490 (Europe).

Sexes alike. Fw. 45–55 mm. A very handsome and distinctive species with body and wings green, beautifully marked and variegated with darker green and pink.

RANGE AND HABITAT
Very common throughout the Ethiopian Region, including Madagascar. Also in Southern Europe,

Middle East, North Africa, India and Ceylon. A strong migrant, occasionally recorded from Britain, France, Germany and Russia, and also from various parts of Arabia.

EAST AFRICAN RECORDS

KENYA	NM :	Nairobi, Nyeri, Kinangop, Nakuru.
	SM :	Shimo-la-Tewa, Istsare, Kitale.
	S :	Mombasa.
UGANDA	SM :	Bombo, Kitgum.
	B :	Entebbe, Mpanga, Nakawa.
	L :	Mweya.
TANZANIA	NM :	Amani.
	R :	Arusha, Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea.
ETHIOPIA	NM :	Bongozi (lower Omo River).

Tribe CHOEROCAMPINI

CELERIO Oken 1815

Lehrb. Naturg. **3:** 761; type species *Sphinx gallii* Rottenburg 1775 (Holoarctic Region).

Large robust insects.

First palpal segment not densely scaled at apex (internally); second segment without apical tuft of long scales on inner side. Eye lashed. Antennae incrassate distally, club-shaped in ♀. External spines of foretarsus longer than internal ones. Comb of spines on mid and hind-tarsi vestigial. Two pairs of hindtibial spurs, the inner ones much longer than the outer ones. Abdominal spines strong, particularly on tergites, in series of three rows. Modified scales in ♂ genitalia rather small and numerous.

There are thirteen species in this genus, one of which is cosmopolitan, one Holoarctic, two confined to the Hawaian islands, one to Cuba, one to Madagascar, two South American and five Palaearctic. Several species are strong migrants.

CELERIO EUPHORBIAE (L.) 1758.
Sphinx euphorbiae L. *Syst. Nat.* **10:** 492.

Several subspecies are recognised from different parts of the Palaearctic Region.

Ssp. *mauretanica* (Staudinger) 1871.
Deilephila mauretanica Staudinger, in Staudinger & Wocke, *Cat. Lep.* **2:** 36 (North Africa).
One specimen in the National Museum from the Tibesti mountains, Sahara.

CELERIO BIGUTTATA (Walker) 1856.
Deilephila biguttata Walker *List. Lep. Ins. B.M.* **8:** 172 (Madagascar).
Known from Madagascar only.

CELERIO LINEATA (Fabricius) 1775.
Sphinx lineata Fabricius *Syst. Ent.* : 541 (America).

Ssp. *lineata*.
North and South America.

Ssp. *livornica* (Esper) 1779.
Sphinx livornica Esper *Schmett.* **2:** 88.

Sexes alike. Fw. 30–36 mm. Specimens from very dry areas tend to be smaller. Specimens from southern Europe and North Africa usually exceed 36 mm. Antennae stout, blackish tipped with white. Head light olive brown, whitish laterally. Thorax light olive brown, tegulae edged with white. Abdomen light olive brown, with two large black lateral spots alternating with three white ones near base. Posterior margins of tergites narrowly edged with white and decorated with four black dots. Discoidal cell of fw oblique and sharply pointed at costa. DC of hw short, triangular, sharply pointed at origin of vein 4. Veins 6 and 7 with a common origin, but not stalked. Fw olive brown with a light buff diagonal band from base to apex and a broad, grey terminal band. Veins indicated by creamy streaks. Hw light red with a black base and black submarginal band and a whitish spot near inner margin.

HABITAT AND RANGE
Most habitats, including sub-desert and high mountains, throughout the Ethiopian Region including Arabia and Socotra. Appears to be absent from the equatorial forest belt of the Congo and West Africa. Also common in Southern Europe, North Africa, the Middle East and thence to China and South India. A regular migrant, particularly in North Africa and Europe.
The equal development of all the eye-spots in the larva and the lack of any noticeable thickening of the 5th and 6th segments suggest a primitive condition in the warning devices which are so well developed in some of the following genera.

EAST AFRICAN RECORDS

KENYA	NM :	Magadi, Nairobi, Thomson's Falls, Uaso Nyiro, Naivasha, Voi, Nyeri, Lake Rudolf.
	S :	Mombasa.
	SM :	Istsare, Kitale.
TANZANIA	NM :	Momela, Arusha.
	R :	Ilonga, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea.
UGANDA	L :	Mweya.
	B :	Nakawa.
ETHIOPIA	NM :	Neghelli, Bongozi (lower Omo River).
	GM :	"Eritrea".
SOMALIA	NM :	Durdureh, Murdugh, Hargeisa.
SOCOTRA	NM :	"near R.A.F. Camp".

Ssp. *livornicoides* (Lucas) 1891.
Deilephila livornicoides Lucas *Proc. Roy. Soc. Queensld.* **8:** 73 (Toowoomba, Queensland).
The Australian race; no subspecies of *C. lineata* has so far been recorded from the Malay archipelago or from New Guinea.

RHODAFRA R. & J. 1903

Novit. zool. **9** *suppl.* : 740; type species *Sphinx opheltes* Cramer 1780.

Closely allied to *Celerio* Oken, but differs as follows: Antennae less incrassate distally, more slender; scales of external surface of palpus very long and slender forming a crest which appears as a continuation of the cilia surrounding the eye; abdominal spines more numerous, but weaker. Tibial spurs

less unequal, tarsal spines weaker; veins 6 and 7 of hw on a short stalk. Larva of *R. opheletes* Cramer without thoracic thickening and with a complete series of equal eye spots; horn very short.

RHODAFRA OPHELTES (Cramer) 1780.
Sphinx opheltes Cramer *Pap. ex.* **3:** 164 ("Coromandel", patria falsa).
1875 *Deilephila mariae* Wallengren *Oefv. Vet. Ak. Forh.* **32,** 1: 93.
A purely South African species.

RHODAFRA MARSHALLI R. & J. 1903. (VII; 9—XV; 16)
Novit. zool. **9** *suppl.* : 741 (Mashonaland, ♂).

Sexes alike. Fw. 23–29 mm. Antennae whitish. Head and thorax light olive-brown, whitish laterally. Abdomen paler olive-brown with two black lateral spots at base. Fw pale cinnamon buff, densely speckled with blackish. A small black stigma and a dark diagonal line from apex to inner margin at $\frac{3}{4}$ from base. Hw rosy red with a large black basal patch and a narrow black submarginal line. Termen and tornus buff speckled with blackish.

♀ GENITALIA: 8th tergite deeply incurved at posterior margin, with a small mesial projection at anterior margin. Vaginal plate consisting of two widely separated lobes at either side of ostium. Ostium very wide, opening ventrally. Colliculum short and wide, bent to the right, tapering at base of ductus. Ductus fairly long, wide with a sharp basal kink. Bursa small, not much wider than ductus. Signum short, U-shaped, near apex of bursa, on right side.

RANGE AND HABITAT
High, open country from Rhodesia to Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Nakuru, Muguga (Nairobi).
TANZANIA	NM :	Mufindi, Mbeya, Ngurdoto Crater.

CHAEROCINA R. & J. 1903

Novit. zool. **9** *suppl.* : 741; type species *C. dohertyi* R. & J. 1903.

Antennae long and slender, of uniform width. 2nd palpal segments open, not mutually appressed as in previous genera, smoothly scaled and without apical tuft; first segment narrow, covered externally by long, hair-like scales, joint of 1st and 2nd segments exposed. Eyes without cilia. Tibial spurs well developed, the inner ones more than twice the length of the outer ones. Tarsal spines strong and numerous. Genitalia of the usual pattern, modified scales very large, with a narrow midrib, very deciduous. Veins 6 and 7 of hw on a long stalk. Early stages unknown. 3 African species.

CHAEROCINA DOHERTYI R. & J. 1903.
Novit. zool. **9** *suppl.* : 742 (Kikuyu Escarpment, Kenya, ♂).
Ssp. *dohertyi.* (VII; 6—XVI; 1)

Sexes alike, although ♀ occasionally paler. Fw. 45–49 mm. Head and thorax dark brown, edged laterally with white, abdomen lighter brown. Fw lighter brown speckled with blackish, with broad basal and discal dark brown fasciae. A blackish ring at end of cell, and a thick dark line from apex to inner margin at $\frac{2}{3}$ from base. Hw bright red with black base and with a black submarginal line

which does not quite reach costa. Underside of body and wings ferruginous speckled with black, legs whitish.

♀ GENITALIA: post-vaginal plate a slender arc. Colliculum very wide and short. Ductus very long, bursa pear-shaped, minutely pitted, but not ribbed. Signum rather short and wide, smooth messially, irregularly dentate laterally.

HABITAT AND RANGE
Highland forest in Kenya and Uganda.
EAST AFRICAN RECORDS

KENYA	NM :	Thomson's Falls, Molo, Kiganjo, Nyeri, Fort Hall, Kaptagat, Kakamega.
	BM :	Uplands, Lumbwa, Elgon.
UGANDA	BM :	Kalinzu, Nyakasura, Impenetrable forest (Kigezi).
	K :	Fort Portal.

Ssp. meridionalis nov. (IX; 10)
Similar to the nominate race, but the black band of the hw is displaced towards the margin, leaving only a very narrow pink terminal fringe, is broader and always reaches the apex.

HABITAT AND RANGE
Highland forest in S. Tanzania and Malawi.

HOLOTYPE ♀: Mufindi, Iringa, Tanganyika, II–1960. P. Burdon, to be deposited in BM (NH).
♀ PARATYPES: 4, data as above, in National Museum, Nairobi. There is also one specimen from Mbeya in the Robertson collection.

CHAEROCINA JORDANI Berio 1938. (VII; 7—XV; 11)
Bull. Soc. ent. Ital. **70:** 85 (Eritrea, ♂).

♂: fw. 37–38 mm. Head and body bright deep green. Sides of thorax whitish pink. Fw deep green with four regular darker green transverse lines, a large black stigma and a black streak at apex. Inner margin narrowly pink. Hw blackish with a large green spot at margin, near tornus. Underside red at base, ochreous speckled with black elsewhere. Tow dark brown crenulate transverse lines, margins dark.
♀: unknown.

RANGE AND HABITAT
Higlands of Ethiopia.
RECORDS

ETHIOPIA	NM :	Adola, Gojeb, Dire Dawa.
	BM :	Harar.

CHAEROCINA ELLISONI Hayes 1963. (VII; 8)
Entomologist **96:** 97 (Harar, ♂).

♂: fw. 34 mm. Head and thorax bright grass green with whitish edges. Abdomen paler green. Fw bright grass green with a straight darker green postmedial line. Hw paler green. Underside green.
♀: unknown.

RANGE AND HABITAT
Highlands of Ethiopia.

RECORDS
Only known from the Holotype and two Paratypes from Harar, all in the BM (N.H.).

EUCHLORON Boisduval 1875

Spec. Gen. Lep. Het. **1**: 213; type species *Sphinx megaera* L. 1758.

Very similar to *Chaerocina;* palpi open as in *Chaerocina,* but outer scaling of 1st segment normal; 2nd segment shorter with bare patch thinly clothed with small rounded scales, and joint of 1st and 2nd segments covered by scales, not exposed. Only one species.

EUCHLORON MEGAERA (L.) 1758.
Sphinx megaera L. *Syst. Nat.* **10**: 492 (Africa).

Ssp. *megaera.* (VII; 5)
Sexes alike. Fw. 40–50 mm. Body and fw bright deep green. Fw with a black and white spot at base, a dark brown spot near tornus and one or two at costa. Hw orange-yellow with an irregular brown margin turning greenish near tornus. A black spot at base and a large, elongated black spot from inner margin to vein 5.

♀ GENITALIA: post-vaginal plate smooth, tongue-shaped. Colliculum broad, tapering from ostium. Ductus long and slender. Bursa oval, pleated and pitted. Signum long, consisting of two series of short irregular transverse ridges, each carrying two or three small teeth, separated by a narrow, smooth median area.

RANGE AND HABITAT
Very common and widely distributed in most habitats except high mountains and very arid areas; most of Africa south of the Sahara, but not in the western Cape. Migratory.
EAST AFRICAN RECORDS

KENYA	NM :	Mombasa, Nairobi, Kakamega.
	SM :	Malindi, Shimo la Tewa, Kitale, Istsare.
UGANDA	NM :	Kampala, Katera, Kamengo, Kibale forest, Budongo forest.
	B :	Entebbe, Mabira, Nakawa, Nyabyeya, Chobe.
TANZANIA	NM :	Amani, Dar es Salaam.
	R :	Arusha, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea.
ETHIOPIA	NM :	Adola.
	GM :	Afgoi.

Ssp. *lacordairei* (Boisduval) 1833.
Faune Madag. & Bourb. : 73 (Madagascar).
Madagascar, Bourbon, Réunion and Mauritius.

BASIOTHIA Walker 1856

List. Lep. Ins. B.M. **8**: 124; type species *B. idricus* Walker 1856, *non* Drury 1782=*Sphinx medea* Fabricius 1781, Africa.

Small, stout insects. Antennae thick, clubbed in both sexes. 1st palpal segment crested apically on inner side, externally convex and with a transverse crest as in *Sphingonaepiopsis.* 2nd segment with

very large internal bare patch. Palpi closed. Eyes strongly ciliated. Abdominal spines numerous, but weak. Genitalia of the usual pattern; modified scales of ♂ long, in a single row of 5 to 8. ♀ with a sharp smooth anterior edge to the ostium, poorly developed post-vaginal plate, long slender ductus, rather short longitudinal signum. Larva strongly tapering in front.

BASIOTHIA MEDEA (Fabricius) 1781. (VII; 10)
Sphinx medea Fabricius Spec. Ins. **2:** 143 (Africa aequinoctialis).
1782 *Sphinx idricus* Drury *Ill. ex. Ins.* **3:** 2 (Africa).
1793 *Sphinx clio* Fabricius *l.c.* **3:** 377 (Guinea).
1797 *Sphinx onotherina* Martyn *Psyche* t.23, f. 59–60.
1860 *Choerocampa transfigurata* Wallengren *Wien ent. Mon.* **4:** 42.

Sexes alike. Fw. 22–25 mm. Body grass green. Fw grass green with 2 or 3 faint darker green transverse lines. Hw dull orange with a narrow brown margin.

♀ GENITALIA: colliculum broad and short, slightly tapering from ostium. Ductus very long, pleated. Bursa rounded, pleated, but not pitted. The smooth median part of signum rather wide, the lateral teeth irregular, arranged in transverse series.

HABITAT AND RANGE
Common in open habitats throughout the Ethiopian Region, including Madagascar; probably absent from the equatorial forest belt, except as a vagrant. An active migrant.
EAST AFRICAN RECORDS

KENYA	NM :	Thika, Thomson's Falls, Nairobi, Sultan Hamud, Mtito Andei, Kitale, Machakos, Aberdares.
	S :	Mombasa.
	SM :	Istsate.
UGANDA	NM :	Kamengo.
	SM :	Bombo.
	L :	Mweya.
	B :	Chobe.
TANZANIA	R :	Arusha, Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora.
	MC :	Lindi, Songea, Nachingwea.
ETHIOPIA	NM :	Dire Dawa.
ERITREA	BE :	Elaberet.

BASIOTHIA CHARIS (Boisduval) 1847. (VII; 11)
Choerocampa charis Boisduval in Deleg. *Voy. Afr. austr. :* 595 (Natal).
1856 *Chaerocampa celerionina* Walker *List Lep. Ins. B.M.* **8:** 136 (Congo).
1875 *Choerocampa celerina* Boisduval *Spec. Gen. Lep. Het.* **1:** 238.

Sexes alike. Fw. 22–25 mm. Head and body golden brown with a double gold dorsal line. Fw golden reddish-brown with a straight whitish line from middle of inner margin to apex. Two parallel darker straight lines near outer margin. Ground colour interrupted by whitish streaks along the veins inside whitish line. Hw crimson with a narrow brown border.

♀ GENITALIA: ostium deeply incurved proximally. Colliculum tapering, curved to the right. Ductus long and slender, with a basal kink. Bursa elongate, pleated and very lightly pitted. Signum of the usual type, but longer than in other species of the genus.

HABITAT AND RANGE

Fairly common in most habitats, excluding very dry areas, throughout Africa south of the Sahara. Not recorded from Madagascar.

EAST AFRICAN RECORDS

KENYA	NM :	Nakuru, Kakamega, Ruiru, Kitale, Aberdares, Mt. Elgon, Kiganjo.
	SM :	Istsare.
	S :	Mombasa.
	BM :	Hoey's Bridge, Kaimosi, Rabai.
UGANDA	NM :	Fort Portal.
	BM :	Masindi.
	B :	Kampala.
	L :	Mweya.
TANZANIA	R :	Arusha, Dar es Salaam, Mbeya, Mlingano, Tabora.
	MC :	Njombe.
ETHIOPIA	BM :	Arussi.

BASIOTHIA SCHENKI (Möschler), 1872.
Chaerocampa schenki Möschler *Stettin ent. Ztg.* **33:** 339 (Natal).
1872 *Chaerocampa protocharis* Möschler *l.c.* **33:** 340.
Recorded with certainty from South Africa and Rhodesia only; frequently confused with the preceeding species.

BASIOTHIA LATICORNIS (Butler) 1879.
Gnathostypsis laticornis Butler *Ann. Mag. nat. Hist.* (5) **4:** 233 (Madagascar).
1879 *Chaerocampa bifasciata* Mabile *Ann. Soc. ent. Frannce:* 345 (Madagascar).
Known from Madagascar only.

BASIOTHIA AUREATA (Karsch) 1891 comb. nov. (VII; 12—XV; 8,13—XVI; 7,8)
Ocyton aureata Karsch *Ent. Nachr.* **17:** 293 (Barombi, Cameroons).
1894 *Lophuron brevipenne* Rothschild *Iris* **7:** 296 (Cameroons).
1903 *Temnora aureata* R. & J. *Novit. zool.* **9** *suppl.* : 569.

Although placed in *Temnora* by Rothschild & Jordan in their Monograph of 1903, the structure of the palpi and of the pilifer as well as the early stages of this species undoubtedly agree with those of the Choerocampini, and particularly of the genus *Basiothia*. *B. aureata*, with its more slender antennae and long-snouted pupa appears to be a link between *Basiothia* and *Hippotion*. The palpi and genitalia agree with those of *Basiothia medea*.
Sexes alike. Fw. 20–23 mm. Head and body reddish-brown, the abdomen decorated with tiny golden dots. Fw reddish-brown mottled with pinkish-brown, particularly at the base, the apex and above the tornus. Numerous oblique darker transverse lines. Hw paler, with a dark brown margin. The females are sometimes darker.

♀ GENITALIA: anterior margin of ostium semi-circular. Colliculum short and wide. Ductus long and slender, slightly kinked basally. Bursa pear-shaped, pitted, but only pleated at the base. Signum short and broad, with prominent teeth.

EARLY STAGES: (after D. G. Sevastopulo).
LARVA (FINAL INSTAR): head green. Body green, a darker green dorsal line and traces of a darker subdorsal line with a few black specks in it. 4th somite with a smoky subdorsal mark with a diffuse

whitish streak across its lower third. 5th somite with an ocellus consisting of a very dark green, white dotted oval pupil, surrounded by a ring, creamy yellow above and red below, the whole ringed by a fine black line and joined to a triangular black spot above. Legs and prolegs pink. Horn thin, straight, smooth and black. Spiracles white with a central black transverse bar.

PUPA: in surface litter. Pale bone with a greenish dorsal stripe on the abdomen and a series of subdorsal black dots, one on each somite. A broken black ventral line. Wing and leg cases finely speckled with black. Spiracles black. Slender in shape, with head produced into a projection rather like a duck's bull. Cremaster a cone ending in a cluster of stout hooked spines.
FOOD PLANT: *Impatiens* sp. (Balsaminaceae).

RANGE AND HABITAT
Wooded habitats from Liberia to Kenya in the east and to Angola, Zambia and Rhodesia in the south.
EAST AFRICAN RECORDS

KENYA	NM :	Nakuru.
	SM :	Kitale, Istsare.
	S :	Mombasa.
	BM :	Eldama, Kaimosi.
UGANDA	NM :	Entebbe, Nyakasura, Fort Portal.
	BM :	Kampala, Katera, Ruwenzori.
	K :	Nagunga.
TANZANIA	NM :	Lyamungu, Arusha, Amani, Mufindi.
	BM :	Kalambo River, Morogoro.
	MC :	Lindi, Songea.
	R. & J. :	Zanzibar.

HIPPOTION Hübner 1822

Verz. bek. Schmett. : 134; type species *Sphinx celerio* L. 1758.

Medium to large sized moths, generally more streamlined than in previous species.
1st segment of palpus densely scaled at apex internally, not convex externally. *H. irregularis* Walker has an apical external cavity as in *Theretra*. 2nd segment without apical tuft of scales. Antennae more slender than in *Basiothia*, clubbed in the ♀. Larva strongly tapering in front, fifth segment enlarged, ocelli present. Pupa with projecting proboscis sheath.
Twenty two species, of which fourteen are Ethiopian, one Ethiopian and Mediterranean, one Old World and six oriental.

HIPPOTION GERYON (Boisduval) 1875.
Choerocampa geryon Boisduval *Spec. Gen. Lep. Het.* **1**: 241 (Antananarivo, Madagascar).
Madagascar and Comoro Islands.

HIPPOTION OSIRIS (Dalman) 1823. (VIII; 4)
Deilephila osiris Dalman *Anal. Entom.* : 48 (Africa).

Sexes alike. Fw. 34–42 mm. Body light brown. Head and thorax brownish pink laterally. Tegulae edged with silvery white and with a longitudinal silvery line from base to apex. Abdomen with a double silvery dorsal line and silvery lateral lines from 3rd abdominal tergite to apex. Two large lateral black spots at base. Fw light brown, with an almost straight triple silvery line from inner margin near

base to apex, a number of pinkish brown streaks in anterior part of wing, and a straight submarginal silvery line followed by a pinkish brown terminal band. Hw bright pink with a black spot near base, some irregular black mottling near costa, and a black submarginal band. Marginal area pinkish brown. Similar to *H. celerio* L. but may be distinguished by its greater size and black lateral spots on abdomen.

RANGE AND HABITAT

Common throughout most of the Ethiopian Region, including Madagascar and the Seychelles. Occasional vagrants have been recorded from Spain. Uncommon on the East African coast. An occasional migrant.

EAST AFRICAN RECORDS

KENYA	NM :	Nakuru, Nairobi.
	SM :	Kitale, Istsare.
	S :	Mombasa.
TANZANIA	NM :	Amani, Musoma, Ukerewe.
	R :	Arusha, Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea, Nachingwea.
UGANDA	NM :	Kampala.
	B :	Jinja, Nakawa, Nyabyeya.
	L :	Mweya.
ETHIOPIA	NM :	Dire Dawa.

HIPPOTION CELERIO (L.) 1758 *Sphinx celerio* L. *syst. Nat.* **10**: 491. (VIII; 1)

1758 *Sphinx tisiphone* L. *l.c.* : 492.

1781 *Phalaena inquilinus* Harris *Exp. Engl. Ins.* : 93.

1815 *Elpenor phoenix* Oken *Lehrb. Naturg.* **3**: 760.

1822 *Hippotion ocys* Hübner *Verz. bek. Schmett.* : 135.

1864 *Deilephila albo-lineata* Montrouzier *Ann. Soc. Linn. Lyons* **11**: 250 (Kanala).

Sexes alike. Fw. 30–32 mm. Similar to *H. osiris* but smaller. Dorsal line on abdomen pale brown, not silvery. Silvery lateral lines interrupted at each tergite. Black lateral spots missing. Ground colour of fw darker, oblique silvery band more prominent, pale markings on anterior part of fw less conspicuous. Hw bright pink at base only; a series of black streaks along the veins connecting black costal area with black submarginal band; marginal band narrower and darker than in *H. osiris*.

RANGE AND HABITAT

Very common throughout the Ethiopian Region including Arabia, Socotra, the Seychelles and Madagascar. Also common throughout the Oriental Region and the southern Palaearctic region, from south Europe to Japan. Also present in Australia, but not in New Zealand. Occasional vagrants have been recorded in Great Britain. It is a vigorous migrant which prefers arid and semi-arid habitats. In forested areas it is much commoner in the dry season than in the wet season.

EAST AFRICAN RECORDS

KENYA	NM :	Nairobi, Sultan Hamud, Makueni, Aberdares, Nakuru,
	S :	Mombasa.
	SM :	Kitale, Istsare.
UGANDA	SM :	Kitgum, Bombo, Entebbe, Kampala.
	B :	Jinja, Nyabyeya, Mweya, Chobe, Nakawa.
TANZANIA	NM :	Amani, Shinyanga.
	R :	Arusha, Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea, Nachingwea.

ETHIOPIA	GM	:	"Ethiopia" and "Eritrea".
SOMALIA	NM	:	Hargeisa.

HIPPOTION CHLORIS R. & J. 1907. (VIII; 6—XVII; 3)
Novit. zool. **14:** 94 (Njoro, British East Africa, ♂).

♂: fw. 32 mm. Body more robust than in previous species, olive green. Fw olive green, marked as in *H. celerio*, but broader, more rounded at termen. Hw as in *H. celerio*, but pink duller, black areas better developed. This species is known from the type only and its appearance and rarity suggest that it is probably a natural hybrid of *H. celerio* and *Basiothia medea*. The genitalia are precisely intermediate between the two species and confirm this view. Natural hybrids of well differentiated species are probably more frequent among the Sphingidae than in most other groups of insects.

HIPPOTION APORODES R. & J. 1912. (VIII; 2—XV; 2,15)
Novit. zool. **19:** 135 (Bibianaha, Gold Coast, ♂).

Sexes alike. Fw. 28–34 mm. Very closely allied to *H. celerio;* it differs in being consistently darker, in the oblique band of the fw being more evenly curved, buff instead of silvery and enclosing 3 narrow but distinct, dark brown parallel lines. Hw as in *H. celerio*, but crimson patch at base deeper in tone, blackish markings better developed, invading most of the wing with the exception of the base, inner margin and a series of internervular post-median spots which are crimson.
♂ GENITALIA: similar to *H. celerio*, but gnathos with a strongly sclerotised apical tooth. Four large modified scales. Harpe sinuous, more slender, smooth. Aedeagus as in *H. celerio*, but apical teeth smaller.

♀ GENITALIA: as in *H. celerio*, but bursa larger, signum a good deal longer.
EARLY STAGES: unknown.

RANGE AND HABITAT
Forests from the Ivory Coast to the Congo and Uganda. A single specimen taken by A. I. D. Robertson at Arusha, must be regarded as a vagrant. *H. aporodes* tends to replace *H. celerio* in the main equatorial forest belt, and the two species appear to be ecological vicariants. In W. Africa *H. aporodes* is a strong migrant, moving regularly North and South with the Intertropical Convergence Zone (J. Bowden, personal communication).
EAST AFRICAN RECORDS

KENYA	NM	:	Kakamega.
UGANDA	NM	:	Fort Portal, Kampala, Kalinzu, Budongo.
	BM	:	Mulange, Jinja, Kamengo.
	B	:	Nakawa.
TANZANIA	NM	:	Minziro forest (Bukoba), Arusha.

HIPPOTION HORUS Rober 1921.
Ent. Rdsch. **38:** 24 (Cameroons).
Almost certainly a synonym of *H. aporodes* R. & J.

HIPPOTION AURORA R. & J. 1903.
Novit. zool. **9** *suppl.* : 812 (Diego Suarez, Madagascar, ♀).

Ssp. *aurora*.
Madagascar and Assumption Islands.

Ssp. *gloriosanum* R. & J. 1915.

Novit. zool. **22:** 293 (Gloriosa Island, near Madagascar).

Ssp. *delicatum* R. & J. 1915.
Novit. zool. **22:** 293 (Farquhar Island, near Madagascar).

HIPPOTION ISIS R. & J. 1903.
Novit. zool. **9** *suppl.* : 753 (patria incognita, ♂).

Based on a single specimen of unknown origin in the Stockholm Museum, but assumed to be African by R. & J. The descrption suggests that it may possibly be a natural hybrid of *H. celerio* L. and *H. eson* Cramer.

HIPPORTION ESON (Cramer) 1779. (VIII; 3)
Sphinx eson Cramer *Pap. exot.* **3:** 57.
1875 *Chaerocampa gracilis* Butler *Proc. zool. Soc. Lond.* : 8 (Congo).

Sexes alike. Fw. 32–40 mm. Head and thorax light brown, edged with white laterally. Abdomen slightly paler, with numerous faint darker longitudinal lines on dorsum and a broader, indistinct golden line on each side. Fw light brown with several darker almost straight marginal and diagonal lines meeting at the apex; a very small black stigma. Hw red with an irregular black spot at base and black at the costa. Tornus fawn, marginal band narrow, light brown, fading towards tornus.

RANGE AND HABITAT
Very common in most habitats throughout the Ethiopian Region, including Madagascar and the Seychelles. Migratory.

EAST AFRICAN RECORDS

KENYA	NM :	Nyeri, Nakuru, Aberdares, Kibwezi, Thomson's Falls.
	SM :	Kitale, Istsare, Elgon,
	S :	Mombasa.
UGANDA	NM :	Kamengo, Aremo.
	SM :	Budongo.
	B :	Entebbe, Kalinzu, Nyabyeya, Mweya, Chobe.
TANZANIA	NM :	Mpanda, Shinyanga.
	R :	Arusha, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea.
ETHIOPIA	NM :	Dire Dawa.

A ♀ in the National Museum (KENYA, Nyeri, 12–VII–1948, C. H. Stockley, No. 11. 484, ex Townsend Collection), is very probably a natural hybrid of *H. celerio* and *H. eson*. Its description is as follows: fw. 35 mm. Body as in *H. eson*. Fw as in *H. eson*, but oblique and marginal bands somewhat more distinct. Hw very pale brown, broadly black at base. A very narrow black submarginal line fading before tornus; narrow black streaks along veins. It could also be a hybrid of *H. eson* and *H. balsaminae* Walker. (VIII ;5)

HIPPOTION BALSAMINAE (Walker) 1856. (VIII; 7)
Chaerocampa bals aminae Walker *List. Lep. Ins. B.M.* **8:** 138 (Natal).

Sexes alike. Fw. 24–28 mm. Head and body very pale sandy brown, with faint darker longitudinal lines. Fw of the same colour with numerous thin darker, regular oblique and submarginal lines meeting at the apex; the two anterior oblique lines darker and more prominent than the others. Hw blackish with a very light sandy brown submarginal line.

RANGE AND HABITAT

Common in most habitats throughout the Ethiopian Region, including Madagascar.

EAST AFRICAN RECORDS

KENYA	NM :	Ruiru, Nairobi, Thomson's Falls.
	SM :	Kitale, Istsare.
	S :	Mombasa.
UGANDA	NM :	Bwamba, Kamengo, Entebbe.
	B :	Mweya, Chobe, Nakawa.
TANZANIA	NM :	Amani, Ukerewe.
	R :	Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Njombe.
SUDAN	NM :	Tombe, Bahr el Ghazal.

HIPPOTION PENTAGRAMMA Hampson 1910. (VII; 15)
Ann nat. Hist. **5:** 455 (British Somaliland, ♂).
1916 *Hippotion roseipennis somalicum* Jordan *Proc. zool. Soc. Lond.* : 140.

Sexes alike. Fw. 22–24 mm. Head, body and fw pale sandy brown. Fw marked with five narrow evenly curved parallel darker lines from inner margin to apex and costa. The intensity of these lines is variable and some specimens are almost unmarked. Hw greyish brown at base, pinkish towards outer margin. Underside pinkish.

♂ GENITALIA: uncus with a sharply downcurved apical tooth. Gnathos short and broad; apex heavily sclerotised, very wide and minutely dentate. Valve with a single very large modified scale. Harpe irregularly sinuate, short, smooth, with point directed upwards. Aedeagus with a single large apical spine directed downwards on the left side and a very small tooth on the right. Vesica unarmed.

♀ GENITALIA: colliculum very deeply incurved at ostium. Ductus long with a saclike flap near base. Bursa elongated pitted and pleated. Signum long and rather wide, its lateral serrated edges narrow, leaving a wide median plate unarmed.

RANGE AND HABITAT

Arid areas in Arabia, Somalia and Ethiopia.

EAST AFRICAN RECORDS

ETHIOPIA	BM :	Dire Dawa.
SOMALIA	NM :	Hargeisa.
	BM :	Daladu.

NOTE: This species is very closely allied to *H. roseipennis* Butler, is very similar to it in appearance, occupies a similar habitat and has identical genitalia in both sexes. Jordan treated it as s subspecies of *roseipennis*, but the apparent absence of transitions despite the lack of any sort of ecological barrier between the ranges of the two insects, suggests that they probably are good species.

HIPPOTION ROSEIPENNIS (Butler) 1882. (VII; 14)
Diodosida roseipennis Butler *Ann. Mag. nat. Hist.* (5) **10:** 433 (Delagoa Bay, ♂).

1915 *Hippotion exclamationis* Fawcett *Proc. zool. Soc. Lond.* : 109 (Masongaleni, B.E.A., ♂).
1930 *Hippotion exclamationis austrinum* Jordan *Novit. zool.* **36**: 5 (Zululand, ♂).

A variable species. Sexes alike. Fw. 22–25 mm. Ground colour of body and fw very pale sandy, to light ochreous-olive, lightly speckled with black in form *exclamationis* Fawcett, darker and heavily dusted with black in form *austrinum* Jordan. Fw with 2 parallel curved lines from inner margin to apex and a dark wedge-shaped stigma. In some specimens the parallel lines are almost wanting, in others they are outlined by dark dots at the veins. Hw brownish, pinkish at the margin. Underside light brown to light reddish-brown variously marked and speckled with darker brown.
Genitalia of both sexes as in *H. pentagramma*.

HABITAT AND RANGE

Dry areas from Natal and Mozambique to Rhodesia, Zambia, Malawi, Tanzania, Kenya, Uganda and S. W. Ethiopia.

EAST AFRICAN RECORDS

KENYA	NM :	Kibwezi, Sekoke, Kisumu, Makueni, Shimba Hills, Mtwapa, Isiolo.
	S :	Mombasa.
	BM :	Gazi, Nairobi, Kakamega.
TANZANIA	NM :	Ukerewe, Ziwani, Moshi.
	R :	Dar es Salaam, Ilonga, Mlingano, Tabora, Ukiriguru.
	BM :	Mwanza, Banagi.
UGANDA	BM :	Jinja, Kibero (Unyoro).
	L :	Mweya.
ETHIOPIA	NM :	Bongozi (lower Omo River).

HIPPOTION REBELI R. & J. 1903. (VII; 16)
Novit. zool. **9** *suppl.* : 761 (Bahr el Seraf, Sudan, ♀).

Sexes alike. Very similar to *H. roseipennis*, and equally variable, but larger and generally more reddish on both sides and more heavily marked. Fw. 25–28 mm.

♂ GENITALIA: very similar to *H. pentagamma* and to *H. roseipennis*, but differs in having a shorter, more sharply upcurved harpe and a long, curved apical spine on the aedeagus.

♀ GENITALIA: very similar to the two preceding species, but colliculum shorter and broader.

RANGE AND HABITAT

Dry areas in northern Uganda, Kenya, Tanzania, the Sudan, Ethiopia, Somalia and Arabia.

EAST AFRICAN RECORDS

KENYA	NM :	Ndoto, Kinna, Voi.
UGANDA	B :	Chobe.
SUDAN: Bahr el Seraf (Type, Vienna Museum).		
ETHIOPIA	NM :	Dire Dawa, Bongozi (lower Omo River).
ERITREA	NM :	Dorfu.
SOMALIA	NM :	Hargeisa.
	BM :	Berbera.
	PM :	Obock.
TANZANIA	NM :	Manyara, Dar es Salaam.

HIPPOTION IRREGULARIS (Walker) 1856. (VIII; 8—XV; 3)
Pergesa irregularis Walker *List. Lep. Ins. B.M.* **8**: 152 (West Africa, ♀).

1886 *Theretra crossei* Rothschild iii, p.22, n.3 (Assaba) (*sic* in *Novit. zool.* **9** *suppl.* : 761).

1st palpal segment with an external apical cavity, as in *Theretra*. Sexes alike. Fw. 33–36 mm. Body and fw olive-ochreous. Fw slightly mottled with brown and marked with a few faint oblique lines, evenly curved from inner margin to apex, crenulate near margin. A small blackish stigma and a series of blackish dots at the veins from middle of inner margin to apex. Hw dark brown with a pale spot at tornus.

♂ GENITALIA: uncus apically blunt. Gnathos short and broad, very heavily sclerotised apically. Valve narrow, with 4 large modified scales. Harpe short, terminating in 2 sharp spines. Aedeagus apically unarmed. Vesica unarmed.

♀ GENITALIA: ostium surrounded laterally and posteriorly by a wide sclerotised band. Colliculum broad and very short. Ductus slender and extremely long, with a basal kink. Bursa rounded and pitted. Signum of the usual pattern, long and rather broad.
EARLY STAGES: unknown.

RANGE AND HABITAT
Forests from Liberia to the Congo, Uganda and W. Kenya. Also in the Usambara area of Tanzania.
EAST AFRICAN RECORDS

KENYA	NM :	Kapsabet, Kakamega.
UGANDA	NM :	Kamengo, Kampala, Masaka, Budongo.
	SM :	Bombo, Katera.
	BM :	Entebbe.
TANZANIA	NM :	Amani, Ilonga.
	BM :	Nguelo.
	R :	Mlingano.

HIPPOTION ROSAE (Butler) 1882.
Darapsa rosae Bulter *Ann. Mag. nat. Hist.* (5) **10:** 433 (Delagoa Bay, ♀).

Ssp. *rosae*. (VIII; 9)
♂: fw. 40–43 mm. Head and body grey; sides of thorax white. Antennae bright pink. Fw grey, speckled with blackish. Faint traces of darker antermedial and postmedial lines. A prominent black stigma and some dark irrorarions alternating with creamy ones at the hind margin. Hw grey, with a yellowish tinge. Cilia chequered. Underside uniform light grey with dark speckles.

GENITALIA: uncus and gnathos slender, of similar length. Harpe rather long, apically upcurved, with irregular upper margin. Aedeagus rather short and stout, slightly curved, with a dorso-apical reflexed flange terminating in two lateral dentate processes. Vesica unarmed. Modified scales small and numerous.

♀: fw. 41–45 mm. Similar to ♂, but wings broader and more rounded.
GENITALIA: colliculum broad, tapering towards ostium, wider at base of ductus. Ductus very wide and short, with two lateral sac-like extensions. Bursa long, but no wider than ductus, pleated, but not pitted. Signum of the usual pattern, but ending well short of the apex of the bursa.

HABITAT AND RANGE
Dry areas from South-West Africa to Mozambique and northwards to East Africa. The ♂ are very much rarer than the ♀.

EAST AFRICAN RECORDS

KENYA	NM :	Shimoni, Mombasa.
	BM :	Simba.
UGANDA	S :	Kampala (One ♀, should be regarded as a vagrant).
TANZANIA	R :	Dar es Salaam, Ilonga, Mlingano, Ukiriguru.
	MC :	Lindi, Songea.
	ESB :	Manyara.

Ssp. guichardi nov. (X; 1,2—XV; 4)
Differs from the nominate race in being smaller and broader winged, with less acute apices and less produced tornus. Antennae pink, but paler than in *rosae;* colour of wings and body greyer without trace of buff and all markings only very faintly indicated. Genitalia as in *rosae.* Fw 29 mm. in ♂, 34 mm. in ♀.

HOLOTYPE ♂: Socotra, Hadibo Plains, 12–IV–1967, *leg.* K. M. Guichard, British Museum No. 1967–389.
ALLOTYPE ♀ : Socotra, Hadibo Plains, 3–V–1967, *leg.* K. M. Guichard, British Museum No. 1967–389.
Both specimens in British Museum, Natural History.

HIPPOTION DEXIPPUS Fawcett 1915.
Proc. zool. Soc. Lond. : 109 (Kedai, B.E.A., ♂).

♂: very similar to *H. rosae*, but antennae grey, colour slightly more ochreous, dark markings slightly better developed. Usually smaller than *H. rosae* (34–36 mm.).
GENITALIA: as in *G. rosae.*
♀ AND EARLY STAGES: unknown.

RANGE AND HABITAT
Dry areas in eastern Kenya.
RECORDS

KENYA	BM :	Kibwezi, Kedai.

NOTE: The scantiness of the material available makes it impossible to assess the true status of this insect. It is unlikely to be a northern race of *H. rosae*, as the ranges of the two insects overlap in eastern Kenya; it could however be a seasonal form of *H. rosae* restricted to the drier parts of its range.

HIPPOTION MOOREI Jordan 1926. (VIII; 11—XV; 1—XVI; 4)
Novit. zool. **33:** 383 (Mwanza, ♂).
1926 *Hippotion moorei canens* Jordan *l.c.* (Daladu, Ethiopia, ♀) syn. nov.

Very similar to *H. rosae*, but can be readily distinguished, by the absence of the white margins to the tegulae, the thorax being unicolorous. Sexes similar, but ♀ larger, broader winged. Fw 28–34 mm in the ♂, 35–40 in the ♀. Antennae bright pink. Some specimens (form *canens* Jordan) are identical with *H. rosae*, except for the absence of the white margins to the thorax. Others (form *moorei* Jordan) have pinkish hw and are pinkish below. More extreme specimens are completely bright vinaceous above and below, speckled with blackish. All transitions between the extreme grey and pink forms occur in the same localities and therefore there is no question of subspecific differentiation. These forms are probably seasonal and climatic, the grey individuals being wet season forms.

♂ GENITALIA: as in *H. rosae*. The upper part of the valve shows numerous small scars, suggesting the loss of numerous small modified scales. However, the scales, if present, must be extremely deciduous, as none were found on any of the specimens dissected.

♀ GENITALIA: as in *H. rosae*.
EARLY STAGES: unknown.

RANGE AND HABITAT
Dry areas from northern Tanzania to Ethiopia and Somalia.
RECORDS

KENYA	NM	:	Mtito Andei, Voi, Melka Murri (Mandera).
	BM	:	Kitale, Makindu.
TANZANIA	NM	:	Ukiriguru.
	BM	:	Mwanza (type)
	ESB	:	Manyara.
ETHIOPIA	BM	:	Daladu.
SOMALIA	NM	:	Hargeisa.
	BM	:	Malka Re,

HIPPOTION SOCOTRENSE (Rebel) 1899.
Metopsilus socotrensis, Rebel. *Sitz. Ber. Akad. Wiss. Wien.* 1899: 360 (Socotra, ♂).

Ssp. *socotrense*. (VII; 13—XV; 6)
♂: fw. 22 mm. Antennae pale buff, body and fw ochreous-olive. Fw with indications of an antemedial band, and with a darker, broad diffuse medial fascia. Postmedial and submarginal indicated by 2 dark irregular lines from costa to vein 5. A short, indistinct oblique dark streak at apex. Hw uniformly darker brown. Cilia of both wings chequered.

GENITALIA: uncus slender. Gnathos short, very broad dorso-ventrally, apically sclerotised. Valve with numerous small scars, possibly indicating loss of modified scales. Harpe short, broad, apically upcurved. Aedeagus stout, curved, with a long, oblique apical row of teeth on right side, and a short dentate process on left. A rounded ventro-apical flap. Vesica unarmed.

♀ AND EARLY STAGES: unknown.
This subspecies is only known from the type at the B.M. and from another male collected by G. Popov at Hyama, Socotra, in the National Museum, Nairobi.

Ssp. *diyllus* (Fawcett) 1915 stat. nov. (VII; 17—XV; 5,14)
Hippotion diyllus Fawcett *Proc. zool. Soc. Lond.* : 109 (Kedai, B.E.A., ♂).

Sexes alike. Fw. 22–25 mm. Differs from the nominate race in having a paler, more greenish ground colour and a more reduced median band, usually indicated by a large, diffuse, central dark spot.

♂ GENITALIA: very similar to *H. socotrense socotrense*, but gnathos narrower dorso-ventrally, harpe shorter, with dorsal margin more irregular, saccus longer.
♀ GENITALIA: colliculum very short and broad, slightly bent to the right. Ductus very short. Bursa long, slightly pleated, but not pitted. Signum long, almost reaching apex of bursa, with very small teeth almost obliterating smooth medio-longitudinal area.
EARLY STAGES: unknown.

RANGE AND HABITAT

Dry areas from eastern Kenya to southern Ethiopia; almost certain to occur in Somalia, but not yet recorded.

RECORDS

KENYA	NM :	Voi, Mtito Andei, Wajir.
	BM :	Kedai (Type).
	S :	Mombasa.
ETHIOPIA	NM :	Neghelli.

HIPPOTION BUTLERI (Saalmüller) 1884.

Panacra butleri Saalmüller *Lep. Madag.* : 118 (Nossi-Be, Madagascar, ♀). Madagascar only.

HIPPOTION SACLAVORUM (Boisduval) 1833.

Deilephila saclavorum Boisduval *Faune Madag. Bourb.* : 71 (Madagascar). Madagascar only.

HIPPOTION BATSCHI (Keferstein) 1878.

Chaerocampa batschi Keferstein *Jahrb. Ak. Erfurt* (2) **6:** 14 (Tamatave).
1879 *Chaerocampa humilis* Butler *Ann. Mag. nat. Hist.* (5) **4:** 234. Madagascar only.

HIPPOTION GRIVEAUDI nom. nov.

1959 *Hippotion albolineata* Griveaud *Faune Madag.* **8:** 145 (Andranomandevy, East-central Madagascar, ♂).

Proccupied by *Deilephila albo-lineata* Montrouzier 1864, a synonym of *Hippotion celerio* (L.). Madagascar only.

HIPPOTION STIGMA (R. & J.) 1903 comb. nov. (VIII; 10—XV; 7)

Temnora stigma R. & J. *Novit. zool.* **9** *suppl.* : 811 ("between Addis Abeba and Kismayo", ♀).

Sexes alike. Fw. 26–28 mm. Palpi small. Wing margins crenulated; apex of fw blunt, termen concave between veins 3 and 5. Head and body pale grey, with a large dark grey dorsal area on thorax. Fw pale grey; distal half of inner margin very dark grey. Termen dark grey from just above tornus to vein 6. A faint, thin rather wavy line from inner margin to vicinity of apex. Costa darker than rest of wing. A blackish dot at costa before apex; a sharply defined black stigma. Hw. pale grey, with lower half of outer margin and tornus blackish grey.

♂ GENITALIA: uncus downcurved, considerably longer than gnathos. Valve long and narrow, without trace of modified scales in the only ♂ known; a semi-circular thickening on outer surface, near apex of valve. Harpe rather short and wide, terminating in a short, sharp, abruptly up-curved spine. Aedeagus straight, with an apical curved toothed flange terminating in a stout down-curved hook which protrudes beyond apex. Vesica unarmed.

♀ GENITALIA: post-vaginal plate narrow; ante-vaginal plate completely membranous. Colliculum very short, with a slight twist to the right. Ductus very long. Bursa missing in the only ♀ available.
EARLY STAGES: unknown.

HABITAT AND RANGE

Arid regions of eastern and northern Kenya, Ethiopia and Somalia.

RECORDS

KENYA	NM :	Walas Did (Bura).
	BM :	Dandu.
? SOMALIA	BM :	Type.

NOTE: The size, general appearance and shape of this insect are reminiscent of *Temnora* and in fact it was placed in that genus by Rothschild and Jordan. Never-the-less, the structure of the pilifer and of the palpus agree very well with the Choerocampini. Here it is provisionally placed in *Hippotion*, despite the smallness of the palpi, which otherwise agree with that genus, and the unusual shape of the wings. It is most probable that when something is known of the early stages and more material becomes available, a new genus will have to be erected to accomodate *stigma;* however, it would be most unwise to base the description of a new genus on the very scanty and incomplete material available at present.

THERETRA Hübner 1822

Verz. bek. Schmett. : 135; type species *Sphinx nessus* Drury 1773, India.
1858 *Gnathostypsis* Wallengren *Oefv. Vet. Ak. Forh.* **15:** 137; type species *Sphinx capensis* L. 1764.
1882 *Hathia* Moore *Lep. Ceylon* **2:** 19; type species *Sphinx latreillei* Macleay 1827, Australia.

Very similar to *Hippotion;* second segment of palpus with internal apical tuft of scales directed ventrad; apex of first segment densely and regularly scaled internally; an external apical cavity always present on first segment.
Male genitalia as in *Hippotion*, but cornuti present in some species.
Larva more strongly tapering than in *Hippotion*, always ocellated. Proboscis case of pupa always prominent and laterally compressed. About 30 species, 7 of which are African, the remainder Oriental, Australian and Palaearctic.

THERETRA CAPENSIS (L.) 1764. (VII; 12—XVI; 2)

Sphinx capensis L. *Mus. Lud. Ulr. :* 349 (Cape of Good Hope).
1774 *Sphinx megara* Muller *Naturs.* **5:** 642 (India).
1779 *Sphinx aeas* Cramer *Pap. exot.* **3:** 57.
1779 *Sphinx cecrops* id. *l.c. :* 57.
1790 *Sphinx immaculata* Gmelin *Syst. Nat.* **1:** 2386.
1860 *Gnathostypsis ostracina* Wallengren *Wien. ent. Mon.* **4:** 42 (Caffraria).

Sexes alike. Fw. 44–52 mm. Body and fw pale greenish-brown, greyish-green, buff, or pale reddish brown, sometimes with a darker postmedial band. Hw uniform rosy red.

♂ GENITALIA: uncus short, very slender. Gnathos short and broad, slightly upcurved. Modified scales numerous, small, very slender. Harpe a slender upcurved point. Aedeagus stout, armed dorso-apically with an oblique dentate ridge. Vesica armed with two spiny flaps.

♀ GENITALIA: colliculum short and very broad, tapering suddenly at base of ductus. Ductus short and wide. Bursa short and rounded, pleated and minutely pitted. Signum of the usual type, broad, and almost reaching apex of bursa.

RANGE AND HABITAT

Woodland and open habitats from the Cape to Rhodesia, Zambia, Katanga, Malawi, Mozambique and East Africa.

EAST AFRICAN RECORDS

KENYA	NM :	Nairobi, Ruiru, Kiganjo.
	SM :	Kitale, Istsare.
	S :	Mombasa.
UGANDA	NM :	Mt. Kadam, Karamoja.
TANZANIA	NM :	Mufindi, Amani, Momela, Ndolage.
	R :	Dar es Salaam, Ilonga, Mbeya, Mlingano, Tabora, Ukiriguru.
	MC :	Lindi, Songea.
ETHIOPIA	NM :	Neghelli, Bulale.

THERETRA TESSMANNI Gehlen 1927.
Int. ent. Z. Guben **21:** 174 (Cameroon). Cameroon and Nigeria.

THERETRA JUGURTHA (Boisduval) 1875. (VIII; 13—XV; 10)
Choerocampa jugurtha Boisduval *Spec. Gen. Lep. Het.* **1:** 256 (Senegal).
1894 *Theretra obliterata* Rothschild *Novit. zool.* **1:** 75 (Sierra Leone).
1893 *Choerocampa clotho* Schaus & Clemens *Sierra Leone Lepid.* : 18.

Sexes alike. Fw. 37–45 mm. Body and Fw ochreous olive, hw dark brown, very much like a large edition of *Hippotion irregularis* Walker.
♂ GENITALIA: very similar to *T. capensis*, but aedeagus longer, spines of vesica longer,
♀ GENITALIA: very similar to *T. capensis*, but colliculum very much longer.

EARLY STAGES: (after D. G. Sevastopulo)
5TH INSTAR: head and body green. Dorsal area with large yellow dots. A bluish dorsal line. A white subdorsal stripe edged above with dark green from 6th somite to base of horn. Lateral area more bluish; a series of oblique lateral white stripes. Ocellus very protruberant, upper half lilac, lower half white. Horn lilac, very short and downcurved. Spiracles cream. Legs yellow. Venter and prolegs blue-green. Anal flap yellow-green edged with blue-green. Before pupation ground colour changes to olive brown and ocellus becomes black.

PUPA: in slight cocoon in surface litter. Gingery brown minutely speckled with darker brown and with paler specks on abdomen. Head and thorax darker, venter paler with a broad greenish-grey median band. Proboscis sheath not produced frontally, with deep furrow on either side at base. 7th abdominal somite very short, with posterior edge overlapping the 8th which has two deep ventro-lateral pits. Cremaster conical, ending in two divergent bifid spines.
FOOD PLANT: *Vitis* (Ampelidaceae).

RANGE AND HABITAT
Wooded areas in tropical Africa.
EAST AFRICAN RECORDS

UGANDA	NM :	Bwamba, Katera, Makerere.
	BM :	Jinja, Entebbe.
TANZANIA	NM :	Amani.
	R :	Ilonga, Mlingano.
	MC :	Lindi, Songea.

THERETRA CAJUS (Cramer) 1777.
Sphinx cajus. Cramer *Pap. exot.* **2:** 80 (Cape of Good Hope).
1782 *Sphinx celaeno* Esper *Ausl. Schmett.* **2:** 203.

1782 *Sphinx gordius* Stoll, in Cramer, *Pap. exot* **4:** 147.
1822 *Xylophanes gortys* Hübner *Verz. bek. Schmett.* : 136.
1847 *Choerocampa epicles* Boisduval in Deleg., *Voy. Afr. Austr.* : 595 (Zululand).
South Africa and Rhodesia.

THERETRA PERKEO (R. & J.) 1903 stat. nov. (VIII; 15)
Theretra cajus perkeo R. & J. *Novit. zool.* **9** *suppl.* : 781 (Ogrugra, Nigeria, ♂).

Sexes alike. Fw. 19–21 mm. Pinkish-brown with a darker oblique stripe and a parallel series of narrow paler lines from hind-margin of fw to vicinity of apex. Head and body with a dorsal silvery line, hw uniform pinkish-brown. Underside uniform reddish-brown, paler at the margin.

♂ GENITALIA: very much like a *Hippotion*. Harpe long and slender, upcurved. Modified scales large, 5 in number. Aedeagus slightly curved, armed subapically on the right side with an elongated ring of small teeth. Vesica unarmed.

♀ GENITALIA: vaginal plates membranous. Colliculum wide, wider at ductus, curving to the right. Ductus moderately long and slender. Bursa small and rugose. Signum very small, elliptical, near apex of bursa.
EARLY STAGES: unknown.

RANGE AND HABITAT
Arid areas north of the equatorial forest belt, from Senegal to northern Uganda.
EAST AFRICAN RECORDS
UGANDA B : Lukung (Acholi).

This species was treated by Rothschild and Jordan as a subspecies of *T. cajus* Cramer, for reasons which are not clear. Apart from *T. perkeo* being little more than half the size of *T. cajus*, much more slender and very different in appearance, the enormous gap between the ranges of the two insects makes a racial connection extremely improbable.

THERETRA MONTEIRONIS (Butler) 1882. (VIII; 14)
Choerocampa monteironis Butler *Ann. Mag. nat. Hist.* (5) **10:** 433 (Delagoa Bay, ♀).
1923 *Theretra cajus ugandae* Clark *Proc. New Engl. zool. Cl.* **8:** 63 (Kibwezi, Kenya ("Uganda") syn. nov.

Sexes alike. Fw. 20–23 mm. Very similar to *T. perkeo* but ground colour pale brown without trace of pink, pale lines and stripes on wings and body much more prominent, almost silvery.

♀ GENITALIA: colliculum short and wide, tapering towards ostium, curving to the right. Ductus long and wide. Bursa oval, heavily pitted, but not pleated. Signum weak and very short.

RANGE AND HABITAT
Dry habitas from Natal to eastern Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Makueni, Mtito Andei.
	BM :	Kibwezi (Paratype of *T. cajus ugandae* Clark).
	S :	Mombasa.
TANZANIA	NM :	Ilonga, Morogoro.
	R :	Dar es Salaam, Mlingano.
	MC :	Lindi, Songea.

THERETRA ORPHEUS (Herrich-Schaffer) 1854.
Choerocampa orpheus Herrich-Schaffer *Aussereur Schmett.* **1:** 104, (Cape of Good Hope).
1894 *Panacra natalensis* Rothschild *Novit. zool.* **1:** 79 (Natal).

Ssp. *orpheus*. (VIII; 18)
Variable; sexes alike. Fw. 22–26 mm. Fw narrow and long, termen rounded, espcially in ♀, apex not very acute. Body dark brown to dark grey, with numerous paler longitudinal lines. Fw grey, brown or ochreous brown, with one or more curved dark lines from inner margin near base to apex, separated by a conspicuous short pale stripe at inner margin. Basal and anterior portion of wing usually darker. Hw dark blackish grey. In Uganda the much darker, less variegated *T. o. pelius* R. & J. occurs as a form together with the typical form.

RANGE AND HABITAT
Woodland and forest from the Cape to East Africa.

EAST AFRICAN RECORDS

KENYA	NM	:	Kiganjo, Thomson's Falls.
	BM	:	Nairobi.
	SM	:	Kitale.
	S	:	Shimba Hills.
UGANDA	NM	:	Kalinzu, Fort Portal, Budongo, Kamengo.
	BM	:	Entebbe.
	B	:	Mpanga Forest.
TANZANIA	NM	:	Amani, Mufindi.
	R	:	Mbeya.

Ssp. *pelius* R. & J. 1903.
Novit. zool. **9** *suppl.* : 787 (Johann Albrechts Höhe, Cameroons, ♂).
1915 *Theretra orpheus scotinus* R. & J. *Novit. zool.* **22:** 294 (Ilesha, S. Nigeria. ♀) syn. nov.
Paler and narrower-winged than typical race, but of very doubtful validity, as it occurs as an occasional form, together with the very dark form *scotinus* R. & J. throughout the range of *T. orpheus orpheus*, with particular frequence in Uganda. Congo to Sierra Leone.

Ssp. *intensa* R. & J. 1903.
Novit. zool. **9** *suppl.* : 788 (Grande Comore, ♂).
Comoro islands.

Ssp. *malgassica* Clark 1933.
Proc. New Engl. zool. Cl. **13:** 102 (Madagascar).
1956 *Theretra orpheus megalesia* Viette *Lamb.* **56:** 62 (Madagascar).
Madagascar only.

RHAGASTIS R. & J. 1903

Novit. zool. **9** *suppl.* : 791; type species *Pergesa velata* Walker 1853, India.
10 Oriental species and one from Madagascar.

RHAGASTIS LAMBERTONI (Clark) 1923.
Hippotion lambertoni Clark *Proc. New Engl. zool. Cl.* **9:** 48 (Madagascar, ♂).
1959 *Rhagastis lambertoni* Griveaud *Faune Madag.* **8:** 149.
Madagascar only.

CENTROCTENA R. & J. 1903

Novit zool. **9** *suppl.* : 790; type species *Panacra rutherfordi* Druce 1882.

"Differs from *Theretra* in the shorter spur of the midtibia bearing a comb of stiff bristles, as in *Nephele*. Cavity at end of first segment of palpus large and well defined; second palpal segment broader than long. Abdomen with conspicuous tufts at ventral edges of tergites 4 to 6. Distal margins of wings somewhat scalloped".
2 African species.

CENTROCTENA RUTHERFORDI (Druce) 1882. (VIII; 16—XVI; 3)
Panacra rutherfordi Druce *Ent. mon. Mag.* **19:** 16 (Cameroons, ♀).
1890 *Panacra saalmulleri* Möschler *Abh. senckenb. naturf. Ges.* **15:** 68 (Accra, Gold Coast).
1900 *Choerocampa udulata* Aurivillius *Oefv. Vet. Ak. Forh.* **57:** 1050 (Congo).

Sexes alike. Fw. 30–34 mm. Body dark olive brown with longitudinal black lines. A large lateral black spot at base of abdomen. Fw evenly crenulated at margin, dark olive brown, speckled and mottled with ochreous and with black. A straight black line from base to apex, followed by a creamy band, the proximal half of which is straight, the distal half undulate; submarginal area ochreous green, termen and cilia very dark brown except below apex, where they are chequered with cream. Hw evenly crenulate at margin, uniform dark brown.

♂ GENITALIA: uncus and gnathos of equal length, the latter apically sclerotised and dentate. Modified scales of two sizes; a proximal series of 6 large ones and 3 distal series of numerous smaller ones. Harpe slender, apically upcurved. Aedeagus stout and straight, with right side prolonged apically by a long oval lobe armed with small hooks dorsally and ventrally, but smooth and rounded apically; these marginal hooks are frequently broken off during copulation and may be found in the colliculum and ductus of the ♀. Vesica unarmed.

♀ GENITALIA: post-vaginal plate small, triangular, distally curved. Colliculum very short and wide, curved to the right, tapering towards ostium. Ductus very long. Bursa large, pear-shaped, pleated and pitted. Signum long and very broad, well sclerotised and prominently spinose.
EARLY STAGES: unknown.

RANGE AND HABITAT
Forests from Sierra Leone to Uganda and west Kenya; also in the Usambara area of N. E. Tanzania.
EAST AFRICAN RECORDS

KENYA	NM :	Kakamega.
UGANDA	NM :	Kamengo, Kalinzu, Fort Portal, Budongo, Kayonza.
	BM :	Jinja.
	K :	Kampala, Kawanda.
TANZANIA	NM :	Amani.
	BM :	Nguelo.

CENTROCTENA IMITANS (Butler) 1882. (VIII; 17—XV; 9)
Panacra imitans Butler *Ann. Mag. nat. Hist.* (5) **10:** 432 (Delagoa Bay, ♂).

♂: fw. 29–31 mm. Very similar to the previous species, but differs as follows: crenulations of fw termen deeper, irregular, the apex and the end of vein 5 being more prominent than remainder of termen; black spots at base of abdomen lacking; ground colour very dark sepia to creamy, lacking

all traces of yellow and green; oblique creamy band of fw with straight margins throughout its length, not undulate in distal half.

GENITALIA: very similar to previous species, but aedeagus with a broad flat, apically dentate apical process on right side and a short subapical dentate crest on left.
FEMALE AND EARLY STAGES: unknown.

HABITAT AND RANGE
Wooded areas of eastern Africa, from Mozambique to East Kenya.
EAST AFRICAN RECORDS

KENYA	NM :	Shimba Hills, Mombasa.
	BM :	Nairobi.
TANZANIA	BM :	Uluguru Mts.
	R :	Dar es Salaam, Mlingano, Ilonga.

ADDENDA

The following species have been recently captured by Mr. A. L. Archer near Sango Bay, Uganda:

Libyoclanis bicolor Rothschild
Temora reutlingeri Holland
Hypaedalia lobipennis Strand

ACKNOWLEDGEMENTS

The writer would like to express his gratitude to the following persons, without whose assistance this work would not have been possible:—

Messrs P. Doncaster, D. S. Fletcher and W. H. T. Tams of the British Museum (Natural History) for loan of material, advice, and facilities for studying the incomparable collections of the British Museum.

Drs. J. Bourgogne, P. Viette and P. C. Rougeot of the Muséum National d'Histoire Naturelle, Paris, Dr. L. Vari of the Transvaal Museum, Pretoria, Dr. Hannemann of the Humboldt University Museum, Berlin, Dr. L. Berger of the Musée Royal de l'Afrique Centrale, Tervuren, Prof. Tortonese and Dr. E. Berio of the Museo Civico di Storia Naturale, Genova, Dr. H. Clench of the Carnegie Museum, Pittsburgh, and the late Col. H. F. Stoneham of the Stoneham Museum, Kitale for loans of specimens, information and photographs of the type specimens and other material of critical importance.

Mr. K. W. Brown of the Uganda Forestry Department, Mr. E. S. Brown of the East African Agriculture and Forestry Research Organisation, Dr. C. McCleery of Lindi, Tanzania, Dr. G. Pringle of the E.A. Malaria Institute, Amani, Tanzania for loans and gifts of specimens and information.

Prof. J. Bowden of the University of Ibadan, Nigeria for kind permission to make use of the unpublished results of his research on the flight and migration of the Sphingidae in Ghana.

Finally very special thanks are due to Mr. D. G. Sevastopulo of Mombasa for permission to use his extensive notes and photographs of the early stages of East African Sphingidae, to Mr. Ian Robertson of the Department of Agriculture, Tanzania for making available Sphingid records and specimens from 5 Mercury Vapour light traps over a period of several years, and to Dr. J. M. Lock of the Nuffield Research Unit for details of a collection of Sphingids made at Mweya, Queen Elizabeth National Park, Uganda.

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GLOSSARY

ACUMINATE	Ending in a sharp, slender point
AEDEAGUS	The penis of an insect
AESTIVATION	A passive state in which the animal does not feed or grow, which enables it to survive a hot, dry season
ALLOPATRY, ALLOPATRIC	Refers to species with a different range
ALLOTYPE	The specimen from which the second sex of a new species or subspecies is described. If the first specimen (holotype) to be described is a male, the allotype is a female, and vice versa
ANELLUS	A ring-like structure through which the aedeagus (penis) slides when extruded or withdrawn
APOSEMATISM, APOSEMATIC	The possession of bright colours or of a conspicuous pattern which help to warn predators of the distasteful or toxic properties of its owner
BURSA (BURSA COPULATRIX)	A membranous bag attached to the vagina of the female, in which the sperm is stored after copulation
CARINATE	Keeled
CELL (DISCOIDAL)	An elongated basal ring formed by two longitudinal veins connected by a transverse cross-vein from which most of the other veins of the wings radiate
CHITIN, CHITINISED	A hard, durable substance which reinforces all the hard external structures of insects
CHRYSALIS, (=PUPA)	The passive phase which insects undergo between the caterpillar stage and the emergence of the adult
CILIA	Slender scales forming the fringe of the wings; long hair-like scales, usually protecting the eye
CLASPER	Paired lateral flaps at the end of the abdomen of the males which help to hold the female during copulation. (see also valve); last pair of prolegs (false legs) of the caterpillar
CLINE	Distinct populations at the extremes of a specific range linked by intermediate populations in the intervening areas
CLYPEUS	A large triangular plate at the front of an insect's head
COLLICULUM	A chitinised tube opening externally into the ostium (vagina) and internally into the ductus bursae
CORNUTI	Chitinised spines or plates with which the bladder of the penis (vesica) is sometimes armed
COSTA	The leading (anterior) margin of the wings; the dorsal margin of the clasper
COTYPE	A member, other than those specially designated, of a series of specimens from which the description of a new species or subspecies was written
COXA	First segment of the leg
CREMASTER	A hook or spine at the anal end of the pupa
CRENULATE	With small, regular indentations or undulations
CRYPTIC	Colours, markings or postures which assist concealment
CUBITUS	The lower (posterior) arm of the discoidal cell
DENTATE	Toothed
DIAPAUSE	A completely passive stage in an insect's life during which all activity is suspended, there is no growth and metabolism is slowed down
DIMORPHIC, DIMORPHISM	A species with individuals constantly exhibiting two different colour patterns

DISCAL	Pertaining to the central part of the wing, where the discoidal cell is placed
DISCOIDAL (CELL)	See cell
DISJUNCTION, DISJUNCT	A complete break in the geographic range of an organism
DISTAD	Directed away from the centre, or base of an object
DISTAL	Portion furthest away from the centre, or base
DORSAD	Directed towards the dorsum
DORSAL	Pertaining to the dorsum
DORSUM	Upper surface of an organism in a horizontal postion; back if in a vertical position
DUCTUS (BURSAE)	Tube connecting the vagina or colliculum with the bursa
ECLECTIC	Widespread and adaptable
EMARGINATION, EMARGINATE	A marginal concavity sufficiently deep or irregular to give the appearance of incompleteness
ENDEMIC, ENDEMISM	Occuring in one locality or area only
EPICRANIUM	The upper part of an insect's head, in which the sockets of the antennae are placed
EPISTOME	Base of the proboscis
FACIES	External appearance
FALCATE	Pointed apex, suggesting the bill of a hawk
FASCICULATE	Armed or decorated with bundles of cilia at regular intervals
FEMUR	The third segment of an insect's leg
FRENULUM	A long stiff bristle at the base of the hindwing
FRONS	Front of the head
FRONTAD	Directed towards the front
GENAL (PROCESS)	Triangular process separating the pilifer from the eye
GLOSSA	Tongue
GNATHOS	The 10th sternite in the male
GYNOTROPIC	Movement directed towards the female; attracted by the female
HABITAT	The sum of environmental conditions required by a species
HARPE	Spiny process inside the valve of a male insect
HIBERNATION	Diapause or quiescensce which takes place in winter
HOLOTYPE	The individual specimen from which a species is described
HYALINE	Glass-like, transparent
INCRASSATE	Thickened
INCURVED	A regularly curved concavity of the margin
INSTAR	Stages between moults of a caterpillar
INTERNERVULAR	Between the veins
LABRUM	Anterior edge of clypeus, sometimes projecting beyond base of proboscis
LANCEOLATE	Shaped like the blade of a spear
LARVA	Active immature stage unlike the adult (caterpillar)
LATERAD	Directed towards the side
LIGULA	Soft, fleshy flap below labrum of caterpillar
LINGUIFORM	Shaped like a tongue
LUNATE	Shaped like a crescent moon
LUNULE	A small crescent shaped spot
MAXILLA	Appendages of the mouth which, in the Lepidoptera, are fused with the glossa to form the proboscis
MENTUM	A transverse strip of chitin below the base of the proboscis
MERUM	Ventral chitinised plate behind the one in which the leg is articulated
MESIAL, MESIALLY	At the middle

MESOTHORAX	Second segment of the thorax
METATHORAX	Third segment of the thorax
NEALLOTYPE	Specimen from which the second sex of a species or subspecies is described, if published subsequently to the description of the Holotype
NERVULAR	Pertaining to the veins of the wing
NICHE	Position of a species within its habitat and community
NOMINATE	Subspecies to which the type of the species belongs
OCCIPUT	Third, or posterior segment of the head
OCELLUS	Single eye, or eye-like spot
OPERCULUM	Portion of colliculum, or vaginal tube projecting beyond ventral surface of abdomen
OSTIUM	Vaginal opening of female
OVIPOSITOR	Structure carrying the egg pore
OVOID	Egg-shaped
OVUM	Egg
PALPUS	Paired processes flanking the proboscis, consisting of 3 segments
PAPILLA	Small nipple-like projection
PARAPLEURUM	Lateral plate of the thorax
PARASITOID	An internal parasite which always kills its host
PARATYPE	A member of a type series other than the holotype or allotype, designated by the author
PARONYCHIUM	Paired lateral process of the foot of an insect
PATAGIUM	Small paired dorso-lateral flap behind head
PECTINATED, PECTINATION	Armed with one or more series of processes or cilia, comb-like
PILIFER	A bristly process between the genal process and the base of the proboscis
PILOSE	Hairy
PILOSITY	Hairiness
POLYMORPHISM, POLYMORPHIC	Exhibiting several different colour patterns in one species
POSTDISCAL	Beyond the discal area of the wing
PROBOSCIS	Coiled tube through which fluid is sucked
PROLEG	Abdominal legs of the caterpillar which are lost in the adult
PROTHORAX	First segment of the thorax
PUBESCENCE, PUBESCENT	Covered by short dense fuzzy hairs
PULVILLUS	Pad between the claws of an insect
QUADRATE	Squarish
RADIUS	Anterior arm of the discoidal cell
REFLEXED	Bent backwards
RENIFORM	Kidney-shaped
RETICULATE, RETICULATION	Net-like markings
RETINACULUM	Flap at the base of the forewing below which holds the frenulum in the males
RHOMBOID	Roughly diamond-shaped
RUGOSE	Wrinkled
SACCATE	Sack-shaped
SACCUS	A sack-like process, part of the 9th sternite of the male
SAGITTATE	Shaped like an arrow-head

SCALLOPED (MARGIN)	With prominent, step-like emarginations
SCLERITE	Chitinised plate
SCLEROTISED	Chitinised
SCULPTURED	Surface with raised pattern or with regular pattern of small cavities
SUBAPICAL	Immediately before the apex
SUBBASAL	Immediately beyond base
SUBDORSAL	Below the dorsum
SUBLATERAL	Above the venter (sternum)
SUBMARGINAL	Immediately inside the outer margin
SUBSCAPHIUM	A process originating below the gnathos
SUBSPECIATION	Processes leading to the evolution of a subspecies
SUBTERMINAL	See submarginal
SUTURE	Line where two chitinised plates meet
SYMPATRIC, SYMPATRY	Two or more populations with an overlapping range
TARSUS	The last five short segments of the leg
TAXON	Category used for purpose of classification, such as species, genus, family etc.
TAXONOMY	The study of the classification of animals etc.
TEGULA	Dorso-lateral flap attached to the mesothorax
TEGUMEN	9th tergite of the male
TERGITE	Dorsal plate
TERGUM	Dorsum
TERMEN	Outer margin
TIBIA	Fourth segment of an insect's leg
TOPOTYPICAL	A specimen from the same locality as the type
TORNUS	The angle between the inner and outer margins of the wings
TRACHEA	Breathing tube
TROCHANTER	Second segment of the leg of an insect
TYMPANAL ORGAN	Organ of hearing at the base of the abdomen found in some insects
TYPE	The specimen from which a taxon is described
UNCUS	The 10th tergite of the male
UNISERIATE	In a single series
UNIVOLTINE	With a single annual brood
UNSCULPTURED	Without surface sculpturing
VAGINA	Opening into which the aedeagus is inserted during copulation (ostium)
VAGINAL PLATE	Chitinised plate surrounding the ostium
VAGRANT	Individual found outside its normal range
VALVE	Paired flaps at the end of the abdomen which help to hold the female during copulation (clasper)
VENTER	Lower, or ventral surface
VENTRAD	Directed towards the ventral surface
VERTEX	Top of head
VESICA	Eversible bladder of the aedeagus
VICARIATION, VICARIANT	Replacement of a species by a close relative in a different area or habitat

(*Received 15/12/1967*)

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Species figured in Hering, 1930 are indicated by S followed by the number of the plate; P indicates species figured in Pinhey, 1962. G species figured in Griveaud, 1959. Genitalia are figured in Griveaud, 1959 and R. & J. 1903 (R followed by sex). Genitalia are also figured in most original descriptions published since 1915. Synonyms marked *

THOMAS HERBERT ELLIOT JACKSON

T. H. E. Jackson, known to his many friends as Pinkie, was murdered by a criminal gang at his home near Kitale, Kenya, on the night of the 22nd of May, 1968.

Pinkie Jackson was born in England in 1903. He was educated at Wellington College, as it was the wish of his father, Brig-General H. K. Jackson, that he should eventually become a regular soldier. However, young Pinkie showed little inclination for the army and after Wellington, went to Harper Adams Agricultural College in Shropshire.

In 1923, after a brief visit to Kenya, he went to India to work on an indigo plantation owned by an uncle. The following year he returned to Kenya for good and after learning to grow coffee for a while with Mr. Maxwell Trench, near Nyeri, he settled on a farm on the slopes of Mt. Elgon, where he was soon joined by his father and family. Coffee had not been grown in that area before, but was eventually established by Pinkie and by his father, and after many vicissitudes the farm "Kapretwa" blossomed forth, to become one of the finest and most successful coffee estates in the district.

At the outbreak of war Pinkie joined the O.C.T.U. and was later drafted to the 4th King's African Rifles.

After some service in that regiment he was seconded to the administration of the Turkana district, where he was largely responsible for raising the "Turkana Irregulars". Later he was charged with the military administration of a large area in Northern Somalia and by the end of the war had reached the rank of Lieutenant-Colonel.

After the war Pinkie Jackson returned to Kapretwa, which he continued to improve and develop in subsequent years.

At the start of the Mau-Mau emergency he volunteered for service, and served in a senior capacity in the Embu district.

Since then he devoted his time to the farm, to his superb garden, and to his entomological activities.

From his early youth Pinkie was a keen naturalist; he developed an absorbing interest in entomology which he pursued throughout his life. In 1928 he took part in the British Museum Ruwenzori Expedition with T. W. Edwards, the dipterist and George Taylor the botanist (now Sir George Taylor, Director of Kew), and collected vast numbers of insects, particularly moths, butterflies and beetles, most of which are in the British Museum collections.

During his many years in Kenya, Pinkie Jackson assembled one of the world's finest collections of African butterflies. All his spare moments were spent collecting in various parts of Africa; he developed new collecting and breeding techniques and trained a number of Africans who were constantly employed collecting butterflies throughout tropical Africa. The results were hundreds of new species and numerous learned publications. In fact his contribution to our knowledge of the African butterfly fauna has been impressive, and probably the most important of the past thirty odd years.

In 1961 Pinkie began to feel that his collection should be more readily available to scientists, and sent part of it to the British Museum. The bulk of the collection and his very fine entomological library were willed to the National Museum in Nairobi.

Pinkie took great delight in all aspects of nature and was an excellent field ornithologist and botanist. Over the years he built up one of the most beautiful gardens in Kenya, as well as an outstanding collection of local and exotic orchids.

It is easy enough to record the bare facts of Pinkie Jackson's life and his achievements as an entomologist, as a farmer and as a gardener, but it is impossible to convey adequately the warmth and charm of his personality.

The brutal murder of this unfailingly kind, generous and wise man has been a great shock to everyone who knew him and a grievous loss to his many friends and relatives and to African entomology.

One must end this very inadequate tribute to a fine man and a dear friend with an expression of deepest sympathy to his two surviving sisters.

R. H. C.

JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. XXVII No. 1 (116) **JANUARY 1968**

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(Published 8/11/68)

Price Shs. 20/-

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All correspondence in connection with this Journal should be addressed to:
The Secretary, East Africa Natural History Society,
P.O. Box 4486, Nairobi, Kenya.

MARINE BOTANY OF THE KENYA COAST
2. A SECOND LIST OF KENYA MARINE ALGAE

By

WM. EDWYN ISAAC

University College, Nairobi

ACKNOWLEDGEMENTS

Thanks are due to the Rockefeller Foundation whose financial support has made this work possible. Thanks to Botanical Institutions are as recorded in the First List of Kenya Marine Algae (Isaac, 1967). Lastly I wish to thank Dr. Josephine Koster (Rijksherbarium, Leiden) for identifying material of two species of Cyanophyta.

CYANOPHYTA

Lyngbya majuscula (Dillw.) Harv. Kuetz.
In her letter Dr. Koster comments: "... a variable species with 16–60μ thick trichomes, which are blue-green, brownish-green or greyish-violet. It is a common tropical species".

This is certainly a common species along the whole length of the Kenya coast. In places it is prominent both on account of the length of the filaments which may be 14 cms. or more and because of the abundance of such clumps as off shore at Majunguni, Pate Island where it occurred as an epiphyte on stumps and leaves of *Cymodocea ciliata*.

Symploca hydnoides Kuetz. ex Gom.

CHLOROPHYCEAE

Ulotrichales

Enteromorpha The identifications of species of this genus are based on Chapman (1956).
E. compressa (L.) Grev. Ubiquitous and sometimes common.
E. prolifera (Muell.) J. Ag. var. *crinita* Roth.

This species was found in dense mats in places on mud flats in Tudor Creek, Mombasa, individual plants attaining a length of 35 cms. or more.

Cells approximately square and more or less evenly arranged in longitudinal rows. Numerous small setae many of which are monosiphonous in their terminal parts.

Cladophorales

Cladophora fascicularis (Mert.) Kuetz. An ubiquitous species on the Kenya coast. Very variable in length and occurring in both the elongated and the short condensed forms illustrated by Vickers (1908, Pl. 13).

Siphonales

Bryopsis indica A. & E. S. Gepp. This is a distinctive species with its double series of lateral branchlets on each side of the frond axis. Only a few plants have been collected: as epiphytes on *Spyridia insignis*, on the south Kenya coast.

Caulerpa fergusonii Murray. The plants of this species collected on the Kenya coast agree well with the description and illustration (Fig. 3) given by Taylor for plants from Mozambique and Zanzibar. (Taylor, 1967).

The articulations of the frond axis are less well marked than might be expected from the figures given by Murray (1891, Pl. 53, Fig. 1) and by Svedelius (1906, Pl. 140, Fig. 51) for Ceylon plants and by Okamura for Japanese plants (1913–15, Vol. 3, Pl. 130). They are more in agreement with the figure given by Weber van Bosse (1898, Pl. 34, Fig. 12).

A number of depauperated specimens of this species have been collected. These may show articulation of the upright axis more clearly than specimens bearing numerous broadly clavate branchlets. This is illustrated in Fig. 1.

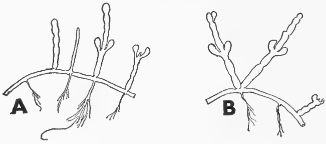

Fig. 1. *Caulerpa fergusonii* Murray
A. Turtle Bay, Isaac 2746.
B. Diani Beach, Isaac 2871.

Codium vaughanii Boergs. prox. This material is chiefly characterised by a well developed halo 2–3mm. wide of dense and continuous pale hairs.

The slimy feel of the plant, its general external morphology and dimensions and the shape of the utricles agree well with Boergesen's description and figures (Boergesen, 1940 and 1946) of the Mauritian plant which he named *C. vaughanii.* The Kenya plants, however, deviate from the Mauritian plants in the absence of terminal swellings to the hairs.

Silva (1959) notes that the Mauritian plant is closely related to *C. prostratum.* Levring & Setchell in a letter to Boergesen (1946) expressed the view that it was almost certainly *C. prostratum*, which view was later accepted by Papenfuss (1944). This view was rejected by Boergesen (1946) and from knowledge of *C. prostratum* in the field, it would seem that this plant is best regarded as a distinct species.

The Kenya plants are tentatively named *C. vaughanii.*

PHAEOPHYTA

Sphacelariales

Sphacelaria furcigera Kuetz. Forming a dense, short epiphytic growth on *Sargassum* and *Turbinaria.* Numerous well developed propagula of characteristic form.

S. novae hollandiae Sond. Found forming a short epiphytic fur on *Turbinaria conoides.*

Many plants observed with more or less triangular propagula showing the characteristic transverse divisions of the corner cells.

Ectocarpales

Giffordia duchassaigniana (Grun.) Taylor. (See Taylor, 1960.)

Illustrated under the name of *Ectocarpus indicus* Sond. by Dawson (Dawson, 1956, Fig. 32) and as *E. duchassaingianus* by Vickers (Vickers, 1908, Pt. 2, Pl. 27) and Boergesen (Boergesen 1914, Fig. 127).

The sparse irregular branching of the Kenya material agrees well with the illustrations of Dawson, Vickers and Boergesen. Dawson comments that the branching habit of this species distinguishes it from *Giffordia mitchellae* (Harv.) Hamel, the plurilocular sporangia of which species are often similar to those of *G. duchassaigniana*. *G. mitchellae* was included in the first list of Kenya marine algae (Isaac, 1967).

Dictyotales

Dictyopteris membranacea (Stack) Batters. The absence of marginal spine-like teeth distinguishes this species from the otherwise similar *D. woodwardii* (Brown) J. Ag.

Cast up at Manda Kitau, Lamu District.

D. repens (Okamura) Boergs. In regard to range of dimensions and character of the branching this is similar to *D. delicatula* Lamour. It is by no means always easy to distinguish herbarium material of the two species. Plants were named *D. repens* if they showed areas of rhizoids arising from the midrib and if at least a proportion of these hairs showed clear terminal expansion into relatively large scutate discs. In places rhizoidal hairs also occur from the margins.

Spathoglossum asperum J. Ag.

Tetrasporic plants with sporangia scattered on both sides of the thallus.

In surface view the cells are more or less in rows and roughly rectangular to irregularly polygonal.

Fewer cells are seen in section than shown by Boergesen (1957) but the anatomical structure is similar, i.e., relatively large cells (one clear row) with a few rows of smaller medulla cells on either side and on both sides an outer bounding layer of small cells.

Fucales

Cystoseira myrica (Gmel.) C. Ag. This species was included in the previous list but it is necessary to point out that two forms of the species occur on the Kenya coast—the large form bearing numerous vesicles and a small stunted form which is evesiculate. The stunted form without vesicles from Mozambique was identified as *C. myrica* by J. Feldmann and was discussed by Isaac and Chamberlain in relation to Inhaca Island (Mozambique) material. (Isaac & Chamberlain, 1958). It was also recorded by the author on the Mozambique coast at Xai-Xai. (Isaac, 1957). More recently Papenfuss and Jensen have discussed the two forms of the species (Papenfuss & Jensen, 1967).

Papenfuss and Jensen regard the two forms as geographical variants and indicate the existence of intermediate forms but noting the occurrence on Mozambique Island of both the forms with vesicles and those without. On the Kenya coast both large vesiculate forms and small evesiculate forms are to be found in the same localities but they are associated with different habitat conditions. In deep pools and in waters beyond the intertidal region the plants are large and with many bladders; but higher up the shore where the plants are periodically uncovered by the tide the plants are small, irregularly branched without vesicles and with a dense covering of spine-like appendages.

RHODOPHYTA

Nemalionales

Galaxaura tenera Kjellm. Plants of this species correspond well with the South African plant so named (Kylin, 1938, Pl. 1, Fig. 2) and with the Mauritian plant (Boergesen, 1942). The East African plants, however, are larger and more frequently of the order of size of Kjellman's original specimen from "Mombasa-Zanzibar". (see Boergesen, 1942). The species was also recorded from Inhaca, Mozambique (Isaac, 1956).

Trichogloea requienii (Mont) Kuetz. One specimen was collected on reef at Diani. Agrees well with Boergesen's illustrations of the species. (Boergesen, 1952, Pl. 1).

Cryptonemiales

A. *Corallinaceae.*

Amphiroa foliacea Lamour.

Amphiroa fragilissima Lamour.

Jania ungulata f. *brevior* (Yendo) Dawson. Material collected agrees well with Dawson's key and figure (Dawson, 1954).

B. Non-Corallinaceae

Carpopeltis rigida (Harv.) Schmitz. At low intertidal levels in more or less turbulent waters.

Gigartinales

Catanella opuntia (Goodenough & Woodw.) Grev.

Occurs intermingled with *Bostrychia binderi* on cliffs and overhangs at high intertidal levels—often above high water level of neap tides.

Eucheuma chondriforme J. Ag. Material collected at Diani shows agreement in regard to size and morphology with Boergesen, 1943, Fig. 23. As in Boergesen's material no central filaments were seen in transverse section. In one specimen examined by Boergeson the main axis was flattened and in the other it was sub-terete. The main axes of the Diani material were terete. Also perhaps the forking of the ultimate branchlets of the Diani material was less marked than suggested by Boergesen's figure.

It should be pointed out that Boergesen referred the material of this taxon to *E. chondriforme* "with much doubt".

E. cupressoideum Web. v-Bosse.

The plants collected approximate closely to var. *verticillata* Yamada. (Yamada, 1936, pp. 131–134).

Gracilaria arcuata Zan.

G. corticata J. Ag. This species can be distinguished by its regularly dichotomous and fastigiate thallus which is of a firm, cartilaginous consistency. It is typically oval in cross section.

G. corticata var. *ramalinoides* J. Ag. In this variety the branching is irregular with short spine-like upper branches. Parts at least are markedly compressed.

Hypnea boergesenii Tanaka. This species differs from *H. valentiae* in that the ultimate lateral branches are both more abundant, and uniformly shorter and often bifurcate. The main axes are thicker and have a dense cover of short branches from the base upwards (Dawson, 1954, Fig. 46k).

At Gazi to seaward of Mangrove, *H. boergesenii* was found epiphytic on *Halodule wrightii.*

H. nidulans Setchell. A common cushion forming species.

Ceramiales

Acrocystis nana Zanard. Large numbers of plants bearing the characteristic small nipple shaped tetrasporic stichidia were found in December 1967 at Malindi and at Diani. These stichidia are mostly borne towards the upper end of the hollow obovate to pyriform determinate branches.

Plants of this species occur in small clumps at, and somewhat below, neap tide high water levels and also in large, dense and compact masses (see Okamura, 1907–09, Pl. 6, Fig. 1) on shaded vertical surfaces high up the shore.

It is probable that at least many of the Kenya plants previously identified as *Botryocladia chiajeana* (Meneghini) Kylin are sterile plants of *Acrocystis nana*. Material from Dar es Salaam was identified by Gerloff as *Botryocladia chiajeana* although this species was previously recorded only for the Mediterranean area and Teneriffe (Gerloff, 1957). Possibly this identification needs to be reconsidered.

Bostrychia binderi Harv. A very widely distributed species on the Kenya coast both on cliffs and overhangs to landward of coral reefs and in Mangroves on parts of trees uncovered by the falling tide.

Chondria dasyphylla (Woodw.) Ag.

Herposiphonia tenella (C. Ag.) Ambronn. A few plants of this minute species were found epiphytic on Melobesieae at Diani.

Tolypiocladia calodictyon (Harv.) Silva.

T. glomerulata (C. Ag.) Schmitz. This small alga was collected from the surface of larger algae over which it creeps. (Outer Reef, Diani).

The species of *Tolypiocladia* are sometimes found under *Rochera* but this name has been shown by Silva to be illegitimate (Silva, 1952).

Vidalia fimbriata (R. Br.) J. Ag. There is an earlier record from Dar es Salaam under the name of *V. melvilli* J. Ag. (See Boergesen, 1945, p. 44; also Boergesen, 1957, Fig. 4).

This is a variable species and the material collected on the Kenya coast shows a fair range of variation including plants agreeing with Fig. 20, Boergesen, 1945; and a small amount of material showing small branchlets arising from the flat surface of the thallus as well as from the margins. (See Boergesen, Pl. 4, 1957).

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MARINE BOTANY OF THE KENYA COAST
3. GENERAL ACCOUNT OF THE ENVIRONMENT, FLORA AND VEGETATION

By

Wm. Edwyn Isaac and Frances M. Isaac

University College, Nairobi

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ACKNOWLEDGEMENTS

The work on which this general account is based was made possible by the generous grants awarded by the Rockefeller Foundation to whom we tender our thanks.

We wish to thank Mrs. Pauline Hall for those drawings of marine algae initialled P.H. and for the drawing of *Turbinaria ornata* we thank Miss Fay Anderson. For information regarding *Turbinaria kenyaensis* and *T. crateriformis* in the Dar es Salaam region we are indebted to Dr. Erik Jaasund, Botany Department, University College, Dar es Salaam.

INTRODUCTION

From north to south, Kenya extends over about 10° latitude while the coastline has a latitudinal extent of about a third of this—from about latitude 1° 40″S. to about 4° 41″S. Further, as compared with the coasts of Norway or the west of Scotland the coastline of Kenya is relatively little indented. Where the coastline is broken or where there are deep inlets, these are in the nature of creeks flanked by mangrove which are characteristic especially of the extreme north and south of this region. The total coastal area of Kenya is relatively small. While the land surface of Kenya extends well north of the equator, the coastline lies entirely to the south of it. (Fig. 1).

The algal flora of the Kenya coast is a rich one and much work will be involved in collecting and identifying all the species that occur on these coasts. A number of new species can also be expected—two new Turbinarias have already been described (Taylor, 1966). The species named in this paper and included in the two lists so far published (Isaac, 1967, 1968) by no means exhaust the roll call of species. The number of small epiphytic species is likely to be appreciable.

* Note the authorities for the Latin names of the Algae can be found in the two Lists, Marine Botany of the Kenya Coast I and First List of Kenya Marine Algae, J. E. *Afr. Nat. Hist.Soc.* **26:**7 5 and on p. 1 of this number.

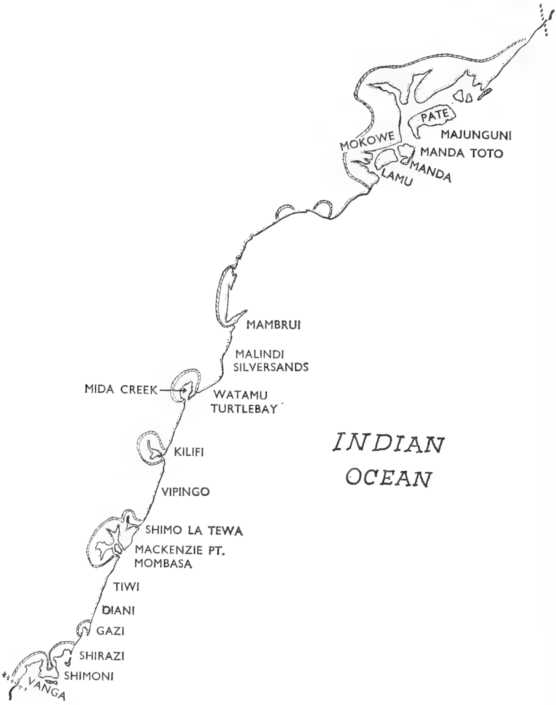

Fig. 1

Kenya Coastline indicating localities referred to and where collections have been made. The areas between the hatched double lines and the shores and the adjacent islands have extensive mangrove forests.

The Tropical waters of the Western Indian Ocean

The simplified general account given below and in the following two sections is based on the relevant parts of the "Africa Pilot" (1954), Newell's monograph (1957) and a popular account in relation to Fisheries by Morgans (1959b).

The stratification of the Western Indian Ocean waters is diagramatically summarised by Newell in Fig. 4 of his monograph. This figure indicates the following layers off the Kenya coast:

(a) Tropical surface water: high temperature, high salinity, oxygen saturated.

(b) Arabian Sea water: high salinity, low oxygen.

(c) Antarctic Intermediate water: low salinity, high oxygen.

(d) North Indian Deep water: a Red Sea outflow of high salinity and low oxygen.

In his simplified account Morgans refers to a surface water layer overlying Arabian Sea water.

Newell's account is based on results obtained in Cruises No. 43 to No. 66 of M.F.R.V. *Research* and cruise No. 67 carried out by M.Y. *Tchita* in 1952, 1953 and 1954 as well as on relevant results obtained during previous Expeditions and especially the *Valdivia, Daona* and *John Murray* Expeditions of 1898–9, 1928–30 and 1933–4 respectively. The area with which Newell was concerned extended from the southern border of Tanzania to the northern border of Kenya and for a distance of. thirty miles out to sea from the shore and including the islands of Mafia, Latham, Zanzibar and Pemba.

The continental shelf is for the most part very narrow off the East African coast, usually extending only two to five miles offshore. The stratification indicated above extends up to the fringing reefs. There is no evidence of a mixing of water masses due to upwelling or downwelling although the lower limit of the upper layer is marked by a relatively rapid temperature change within a relatively short vertical distance, i.e., a thermocline. The depth at which this thermocline occurs, however, undergoes changes.

The water moving over the reefs is that of the surface or upper layer of the adjacent sea unaffected, as mentioned above by upwelling. The thermocline apparently never reaches the reefs. Thus the sea temperatures of the upper layer allow of the development of coral reefs along the whole of the Kenya coast.

The East African Coastal Current

The westward moving South Equatorial Current of the Southern Hemisphere reaches the African coast at about Cape Delgado, about 11°S. latitude. Here arise the southward flowing Mozambique Current and the northward flowing East African Coastal Current. We are concerned only with the latter which governs conditions in the upper stratum of the sea. (Fig. 2 and 3).

The northward extent of the East African Coastal Current varies with the two major monsoon seasons to which the coast is subject but it flows constantly northwards from the southern boundary of Tanzania to at least Malindi. During the south-east monsoon period it continues northwards to Cape Guardafui (Horn of Africa). In broad terms, and disregarding annual variations and transition phases, this extends from April to October/November. During the period of the north-east monsoons from about November to March, however, the northward extent of the East African Coastal Current is more restricted. In this season it meets the southward flowing waters of the Somaliland coast. These two streams of water turn eastwards and join to form the Equatorial Counter Current. In weak north-east monsoons the two streams meet and turn east, north of Lamu. Newell states that this may take place as far north as the equator or at about 1°S. latitude. In strong north-east monsoons on

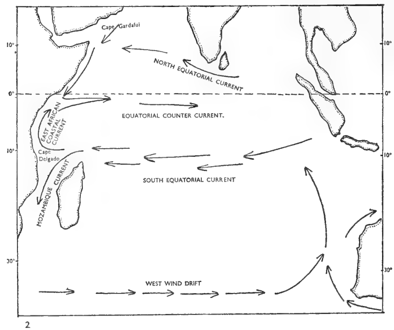

Fig. 2

Indian Ocean in the Southern Summer showing direction of Ocean Currents (after Newell).

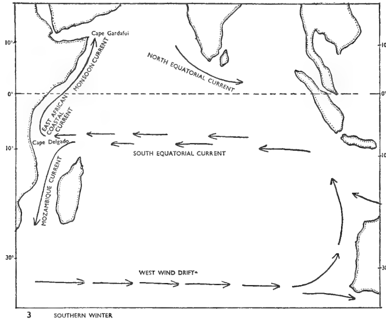

Fig. 3

Indian Ocean in the Southern Winter showing direction of Ocean Currents (after Newell).

the other hand, the meeting of north and south flowing waters is much further south and may occasionally be as far south as Malindi. (Fig. 2 and 3).

The vertical thickness of the East African Coastal Current is greatest towards the end of the south-east monsoon when it reaches a depth of 60–70 fathoms. During the north-east monsoon the vertical thickness is minimal extending at a depth of 30 to 50 fathoms.

The monsoons affect not only the northward extent and speed of the East African Coastal Current but also the salinity of the waters. During the south-east monsoon the shifting of ocean currents brings Pacific water of high salinity into the South Equatorial Current while during the north-east monsoon the South Equatorial Current draws water of low salinity from the Malay Archipelago region. These changes in turn result in corresponding higher and lower salinities of the East African Coastal Current waters. A further factor in relation to salinity is the incidence of rainfall, especially the heavy rains of March to May. From April to June the outflow from the five principal rivers is at its maximum. Prevailing conditions, however, result in the brackish outflow of rivers being kept mostly inshore but according to Morgans rain and river spate reduce salinity only a fraction.

On the basis of Newell's figures surface waters vary from about a minumum of 34.5 to a maximum of 35.4 salinity. As far as the plants of the intertidal region and shallow water are concerned, this variation range is not likely to be significant. Local inshore salinity variations due to brackish water springs flowing on to the shore, or to the immediate proximity of a large river may, however, have significant effects. Such situations favour luxuriant growths of *Enteromorpha* and, near fresh water outflows, local growths of *Grateloupia filicina* and sometimes of the ubiquitous *Centroceras clavulatum* may be found.

The surface sea layer throughout the year has a high oxygen content, almost at saturation. The oxygen content, on the other hand, usually begins to decrease before the thermocline is reached.

Sea Temperatures

Only limited temperature data are available for the region: most of the data were recorded in 1953 and 1954. The available records are of surface temperatures of coastal waters. No records are to hand of inshore temperatures. Coastal surface waters give the general order of temperature but the actual temperatures of inshore waters will vary appreciably depending on local variations in depth, inflow of fresh water and the degree of imprisonment of small bodies of water cut off to a greater or lesser extent from the inflow of water from adjacent areas. On a micro-habitat scale, a walk across a reef at low water will demonstrate appreciable temperature differences between skins of quiet water over a substratum; water of small and large, deep and shallow pools; deep gulfs of water cutting across the reef; and the seaward edge of a reef where water is constantly washing in and out from the open sea.

The average monthly temperatures of surface waters for the whole East African Coast range from 24.8°C. to 29.1°C., the lowest and highest single temperature records being 24.3°C. and 29.7°C. respectively. A South-North sequence of temperatures would have been of interest. An indication is given by four bathy-thermograph tracings, two for Lamu in the North and one each for Kilwa and Mtwara in the South. These indicate somewhat lower temperatures at Lamu than at the two southern stations.

The highest average monthly temperature was recorded for March and lowest for September and in between there was a gradient of decreasing temperatures. After September, average monthly temperatures rose again. This gradient is correlated with the monsoons. As the south-east monsoon develops, the surface water becomes cooler. The north-east monsoon period is generally one of gentle winds and as a consequence the East African Coastal current from December to April becomes layered, a surface skin 10–40 ft. deep of sun-warmed waters floating on colder water below. It is this uppermost layer which attained the March monthly average of 29.1°C. recorded in 1953.

Effects of water movements along East African Coasts on the distribution of plants and animals

To what extent these water movements affect the plants and animals of the intertidal region and shallow waters future investigations will show. There are, however, indications that the distribution of algae and marine angiosperms along the Kenya coast is affected to some extent.

Morgans (1959 a. & b.) suggests that the current flowing southwards along the Somaliland coast might account for a species of rock cod (Serranidae) being caught in fair numbers off Lamu but not further south. According to Morgans this is probably the same fish which is trawled in great numbers just south of India; in which case, it would extend across the northern Indian Ocean and down the African coast to Lamu.

It may also be of significance that a plant of *Scinaia indica* Boergs. was collected cast up at Turtle Bay, Watamu District—the first and only plant so far collected on the Kenya coast. It was recorded by Boergesen from the north-west coast of India; dredged up from about 10 metres at Dwarka and cast up at the nearby Okha Port (Boergesen, 1931).

Two new species of *Turbinaria* have been described by Taylor, viz., *T. kenyaensis* and *T. crateriformis* (Taylor, 1966). They are common on the reef of the South Kenya coast. Fertile specimens of these species have been collected in the Turtle Bay area of the Watamu region. A few stunted, non-fertile plants of *T. kenyaensis* were also found in early December 1967 on the Silversands reef (Malindi). Here this contrasted with the abundance of large fertile *T. murrayana* near the reef edge and of fertile *T. conoides* in quiet water further back from the sea. Fertile plants of *T. kenyaensis* have often been collected in December on the reef at Diani. Neither of Taylor's new species have been found in the Lamu region although more diligent search might reveal them as rare species or of very local occurrence. It is clear, however, that *T. kenyaensis* and *T. crateriformis* are essentially species of the South Kenya coast. This view is confirmed by information received in correspondence with Dr. Jaasund. According to him *T. kenyaensis* is plentiful in the Dar es Salaam area although in that region it shows a marked seasonal fluctuation. On the South Kenya coast moderately large to large fertile specimens have been collected in March, April, June, August and December. Dr. Jaasund has not found *T. crateriformis* in the Dar es Salaam area.

Chamaedoris auriculata was collected by us at a number of places in the Lamu region and Gerloff (1960) records *C. delphinii* from localities in the northern Lamu Archipelago. We found *C. auriculata* in great abundance at Mambrui but nowhere else south of the Lamu region although more intensive collecting may reveal its presence elsewhere. The Mambrui plants were of smaller size than those collected further north. *C. auriculata* occurs on the shores of Dwarka on the north-west coast of India (Boergesen, 1933). *C. delphinii* grows on the east coast of South Africa and northwards to Inhaca Island and Xai-Xai in Mozambique (Isaac, 1956, 1957b); it has also been recorded from Mauritius and Madagascar (Boergesen, 1940). Possibly somewhat higher sea temperatures on the south Kenya coast are less favourable to this species.

Among the species of *Ulva* growing on the Kenya coast are two reticulate forms, including *U. reticulata*. These have been collected by us in abundance on the Kenya coast as far north as Malindi. In places on the outer reef they are very abundant. We have not found reticulate *Ulva* on the northern Kenya coast. It is clear that the reticulate Ulvas are essentially species of the south Kenya coast extending to the coast of Tanzania since a coarse form of *U. reticulata* was observed to be very plentiful around Mafia Island.

Lastly, the case of *Zostera capensis* can be cited. This marine Angiosperm is much more abundant on the north Kenya coast than further south although there is no dearth of equally favourable habitats for it further south.

It is expected that further analysis of records for corresponding habitats will result in a number of additions to the list of species showing a more characteristic north or south Kenya distribution.

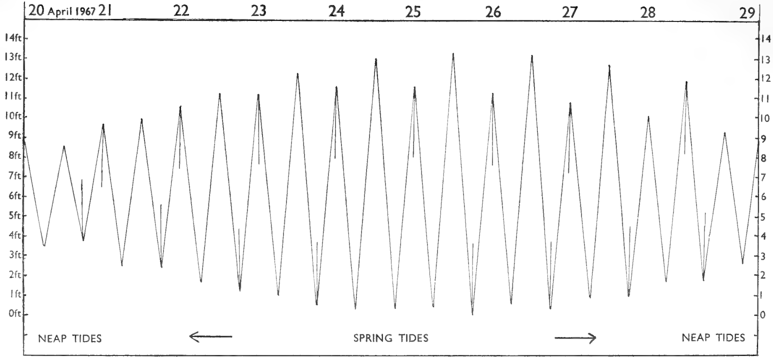

Fig. 4

Graph illustrating the heights of tides at Kilindini Harbour, Mombasa, for the period 20–29th April 1967. (S.E. Monsoon period).

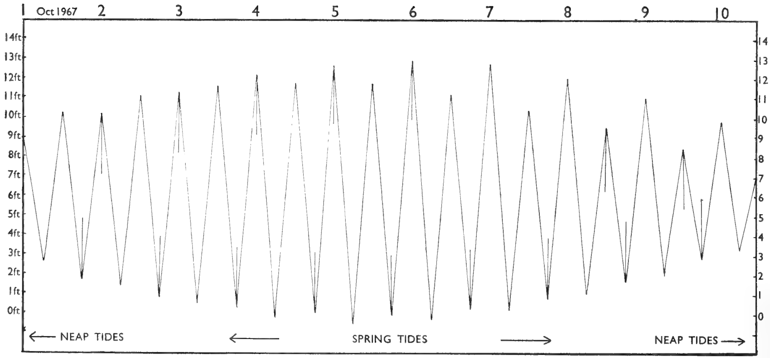

Fig. 5

Graph illustrating the heights of the tides at Kilindini Harbour, Mombasa for the period 1–10 Oct. 1967 (N.E. Monsoon period).

In both graphs above hours of daylight are regarded as 06 hours—18.45 hours. A black line through the peak indicates a high or low tide during hours of darkness. 0 ft. × datum.

Tides

On the Kenya coast there are two tide cycles for every period of somewhat over 24 hours. Except for limited periods in the year, however, the levels of high and low water of each successive tide differ appreciably from the corresponding tide before and the tide following. The tides can thus be designated as mixed tides (Bauer, 1933). This will present a contrast to those familiar only with the semi-diurnal tides around British coasts but will be familiar to those acquainted with Australian or West North American shores. The marked differences which may occur in successive tides is illustrated in Figs. 4 and 5.

Whether the lowest spring tides occur during warmer daylight hours or during the cooler hours of darkness is a matter of extreme importance to biologists studying the biota of the intertidal area and of the shallow seas beyond. Regard being taken only of tides which are no higher at low water than 1.5 ft. above datum, the times of low water of spring tides usually occur between 09.30 hrs. and 13 hrs. during daylight and between 21 hrs. and 01.30 hrs. during hours of darkness. For the years 1965, 1966 and 1967 taking the lowest level for daylight and darkness of each tide cycle irrespective of height in relation to datum, the earliest time of low tide during daylight was 10.07 hrs. and the latest 12.23 hrs., the usual time range for lowest tides being 10.30 to 12.30 hrs. The corresponding times for hours of darkness were 21.51 hrs., and 23.58 hrs. and the range during which most low waters occurred was from 20.15 hrs. to 0.15 hrs.

An analysis of the tide tables published by the East African Railways and Harbours indicates that whether the best working tides are during daylight hours or at night, runs more or less parallel with the monsoons. Apart from some differences from year to year the general picture is as follows. From October to mid-March the lowest tides are during daylight hours. As compared with the corresponding night tides, the daylight low waters are lower by 0.3–1 ft. and mostly lower by more than 0.5 ft. From May to August inclusive, the lowest tides are during hours of darkness and these tides are lower than the corresponding daylight low waters by 0.3–0.9 ft. and are usually 0.5 ft. or more lower. During the second half of March, the first half of April and the whole of September the differences in level between the corresponding daytime and night low waters are small or virtually non-existent. For 1965, 1966 and 1967 the differences at these times do not exceed 0.3 ft. and for more than half of the corresponding pairs of tides the difference is 0.1 ft. or less.

The standard port for Kenya is Kilindini and the level of the sea is expressed as feet above or below datum. The maximum tidal range does not usually exceed about 12.5 feet but may sometimes be over 13 ft.

At any point on the coast there will of, course, be deviations from the data worked out for Kilindini, deviations both in regard to time (e.g. Malindi + 5 minutes; Lamu + 40 minutes) and to levels. Nor should it be overlooked that published tidal levels are levels calculated on expectation. Unusual winds can have considerable modifying effects.

Seasonal changes in marine flora and vegetation

Detailed studies are needed on the changes in the intertidal vegetation throughout the year in a diversity of localities before any general picture of seasonal changes can be given. The observations we have made, however, indicate that the density of vegetation and variety of species is least towards the end of the October to mid-March north-east monsoon period. This period of relative poverty is the time of year when the lowest Spring tides are during daylight hours and when air temperatures are high. By contrast, during the time of year when the lowest Spring tides are at night and the day temperatures are lower, the inter-tidal vegetation and variety of species is at its optimum. This emerged clearly when we compared conditions on parts of the Manda Island coast in July 1965 and in March 1967. On the first visit there was a density of algal growth at low levels and a richness of species, especially of *Caulerpa*, whereas on the second visit there was a relative sparseness. Again, on the reef

shelf between Turtle Bay and Watamu there was a similar contrast as between August 1965 and April 1967.

This difference was also apparent in the mud-flat vegetation at Lamu. In July 1965, *Halodule uninervis H. wrightii, Halophila ovalis* and *H. minor* were plentiful but in March 1967 they were almost absent. *Zostera*, on the other hand, seemed to be unaffected and was present in extensive beds on both occasions. Again, at the north-east corner of Turtle Bay the beds of marine angiosperms were less luxuriant and *Halodule uninervis* had almost disappeared.

Littoral Habitats

Reef and mangrove are the two chief features of tropical shores and the Kenya coast conforms to this pattern since fringing coral reefs are almost continuous except where replaced by mangroves. These latter are often extensive especially along deep inlets from the sea as in Mida Creek, Watamu and Mombasa and bordering relatively narrow channels between islands and between islands and the mainland in the Lamu region. Mangroves are not found where the sea is rough.

While coral reefs and mangroves form, as it were, the general framework on tropical shores, mud, sand-mud and especially sandy areas are extensive and of considerable importance. To seaward of a mangrove the receding tide often lays bare extensive areas of sand, a sand-mud mixture or, as at Mokowe, soft fine mud. Again on the shore behind the reef there may be extensive sandy areas which stretch to a greater or lesser degree into breaks and depressions of reefs. On sandy areas in shallow intertidal waters and in the sub-littoral the most prominent plants are the marine angiosperms popularly known as "sea grasses". They also occur on rocky areas with an overlay of sand. These marine angiosperms are a characteristic feature of tropical shores.

The white line of the waves breaking on the seaward edge of the reef is a familiar sight off Kenya coasts. The distance of the reef edge from the shore varies from place to place, the distance at some points being considerable but an inspection of survey maps indicates that for the most part, the reef edge lies about .25 to .75 of a mile off shore. During low water of a favourable spring tide it is possible to walk on uncovered or almost uncovered reef platform or through a greater or lesser depth of water to the reef edge. In places deeper water channels cut across the platform and thus, while collecting material, it is advisable to have a boat in attendance. Although the platform surface as a whole shows a gentle slope from shore to reef edge, the surface is very uneven, with parts completely uncovered, parts with shallow water, larger and smaller pools and channels. Because of this general character of the reef platform it will be realised:

1. That although relatively few plants and animals remain uncovered at low water at the upper levels of the shore there is a considerable area available for intertidal organisms due to the gentle slope of the platform in conjunction with the appreciable tidal amplitude.

2. The uneven character of the reef surface together with the existence of many pools ranging in depth from little more than water skins to deep pools makes it difficult to recognise zones or girdles of algae such as have been delimited for West European coasts. The difficulty is enhanced by the richness of the flora and the variation from place to place.

As more investigations are carried out on these coasts it should become increasingly easier to characterise species broadly in relation to tidal levels. The picture is likely to be complicated by a consideration of the importance of other factors such as the greater turbulence of the waters at and near the reef edge. There is practically a continuous cover of live coral exposed at low water level of spring tides on the outer reef at Silversands, Malindi. Here there is a relative paucity of plant growth. This illustrates the general phenomenon that a dominance of either plants or animals on a particular area of the intertidal zone results in the near absence of the other as far as macroscopic organisms are concerned.

Exceptions to the absence of species uncovered by the receding tide at higher shore levels are the communities of small algae on shaded rock faces and overhangs where old coral cliffs occur high on the shore. Some of these plants may remain uncovered for a few days during neap tides. *Bostrychia binderi* in general dominates these communities. On some shores certain species such as *Pelvetia canaliculata* (e.g. Isaac, 1933, coast of Glamorgan) and *Porphyra capensis* (Isaac, 1957a, coast of South Africa), have been shown to survive considerable water losses during emersion. From this point of view the study of East African *Bostrychia* would probably prove interesting.

Mangroves

There are extensive mangrove swamps along the creeks and around islands. In the south at Vanga, Shirazi and Gazi; in the central region in the Mombasa area, especially Tudor Creek and its branches, at Mtwapa, Kilifi and Mida Creek; but the most extensive growths of mangrove occur in the north on the mainland and around the islands of the Lamu archipelago. (Fig. 1).

A detailed study of the mangrove swamps has not been attempted by the authors. This brief account which has drawn to a great extent on Graham's paper (1928), will give the character of the chief species.

RHIZOPHORA MUCRONATA Lam. *Mkoko* (Swa.) (Plate 1,A). This is the commonest and most important economically. It can be recognised by its stilt roots which are sent down both from the main stem and from the branches; those from the higher branches may not grow as far as the mud. The leaves are broadly elliptical and strongly mucronate. The embryos which grow and develop hanging from the tree are from 40–60 cm. in length. When they fall into the water they float vertically until they settle on a suitable substratum and begin to grow.

BRUGUIERA GYMNORRHIZA (L.) Lam. *Muia, Mrifu* (Swa.) (Plate 1, B). This is in some respects similar to *Rhizophora* but it has buttress roots near the base of the trunk and the leaves are not mucronate. The embryos, of the same plummet type, are shorter and smaller. *Bruguiera* sends up characteristic "knee-like" pneumatophores from its roots for purposes of aeration.

CERIOPS TAGAL (Perr.) C. B. Robinson *Mkanda* (Swa.) (Plate 1, C). A small tree or shrub which is buttressed at the base, has "knee-like" pneumatophores, smaller obovate leaves and slender, ribbed embryos.

AVICENNIA MARINA (Forsk.) Vierh. *Mchu, Mtu, Mutu* (Swa.) (Plate 1, D). This is often a spreading much branched tree in favourable conditions but may be stunted and shrubby in other places. It has ovate or broadly lanceolate leaves, often greyish on the under surface. The seeds, which germinate on the tree, are of quite a different character from those of the foregoing species. The green cotyledons folded round each other are in the shape of a compressed sphere, and slip out of a slit in the seed coat which remains attached to the tree. The plumule and radicle develop and the young plant is established as soon as it settles in a suitable place. The pneumatophores of *Avicennia* are erect and resemble stout blunt pencils.

SONNERATIA ALBA Sm. *Mililane, Mpia* (Swa.) (Plate 1, F). This is a small, spreading tree with white flowers which have many stamens giving a pompom effect. The fruits with their adhering calyces resemble spinning tops, hence the Swahili name *Mpia*. Each fruit contains many small seeds. The pneumatophores are conical.

LUMNITZERA RACEMOSA Willd. *Kikandaa, Mnwanyana* (Swa.) (Plate 1, E), is a large shrub or small tree with obovate, somewhat fleshy leaves, small white flowers which grow in a spike and have prominent green calyces. It has "knee-like" phenumatophores.

XYLOCARPUS GRANATUM Koen. (Syn. *Carapa obovata* Bl.), is a small tree, much less frequent than those mentioned above. It can be easily recognised by its compound leaves and its large, hard football-like reddish-brown fruits often 6 ins. or more in diameter. This tree has ribbon roots which protrude from the mud to fulfil the same aeration purposes as pneumatophores.

HERITIERA LITTORALIS Ait. usually grows along the water margins of a swamp. *Ceriops* and *Avicennia* may grow with it or slightly further in. In deeper mud *Rhizophora* and *Bruguiera* flourish and on the landward side *Lumnitzera* and to a lesser extent *Avicennia* may cover extensive areas which are only infrequently inundated by the sea.

On sandy areas in and around mangrove a creeping succulent, *Sesuvium portulacastrum* (L.) L., is frequently found.

Marine Angiosperms

Three families of marine angiosperms are well represented on the Kenya coast.

POTAMOGETONACEAE.	*Cymodocea*	*ciliata* Ehrenb. ex Aschers.
	,,	*serrulata* (R. Br.) Aschers.
	,,	*rotundata* Aschers. et Schweinf.
	Halodule	*uninervis* (Forsk.) Aschers.
	,,	*wrightii* Aschers.
	Syringodium	*isoetifolium* (Aschers.) Dandy.
HYDROCHARITACEAE.	*Halophila*	*ovalis* (R. Br.) Hook. f.
	,,	*minor* (Zoll.) Hartog.
	,,	*balfourii* Solered.
	Thalassia	*hemprichii* (Ehrenb.) Aschers.
	Enhalus	*acoroides* (L.f) Rich. ex Steud.
ZOSTERACEAE.	*Zostera*	*capensis* Setchell.

None of the species is endemic and some of them have a most interesting distribution pattern in the Indian, Pacific and Atlantic oceans and, with the exception of *Zostera*, they are nearly all confined to the tropics.

When considering the Kenya coast in general, by far the most prominent species are *Cymodocea ciliata* (Plate 2. F) and *Thalassia hemprichii* (Plate 2, H). They are both plentiful and are found in most places where the substratum is suitable, that is, where there is rock or old coral covered to a greater or lesser degree by sand. They root firmly on the substratum and can withstand fairly rough wave action. *C. ciliata* has not been found in sheltered creeks away from the open sea but *T. hemprichii* does sometimes occur in such places where it becomes luxuriant and may root at a considerable depth.

C. ciliata is at its maximum development both in density of plants and size of individuals in deeper water either within the reef or beyond it, where it is never emersed. It is common in a more stunted form in pools and channels high on the shore where at low water springs it is often at or near the surface of the water with the leaves showing but always wet.

T. hemprichii is abundant at varying depths between the shore and the reef and on flat areas on the landward side of the reef. In and around pools close inshore it is more luxuriant than on flat areas where it is uncovered at low water springs and often shows a marked degree of burning after exceptionally low tides. It frequently forms a dense and dominant mat which gives shelter to many small animals and algae such as *Halimeda opuntia* (Plate 5,B).

Halodule uninervis (Plate 2,C) and *H. wrightii* (Plate 2,B) are both common and widespread but since they are smaller plants covering less extensive areas they are less conspicuous. Highest on the shore is *H. wrightii* frequently in association with *Halophila ovalis* and *H. minor* (Plate 2,L and K). *Halodule wrightii* has narrow grasslike leaves and is able to withstand considerable periods of emersion. It extends in a more luxuriant form into pools in the upper intertidal area but has not been found in deeper water. *H. uninervis* has somewhat broader leaves and is more frequently found in pools and shallow sheltered water where, if uncovered by the tide, it is usually wet. In deeper water in creeks this plant may have branching, almost woody, upright stems and tougher somewhat narrower leaves.

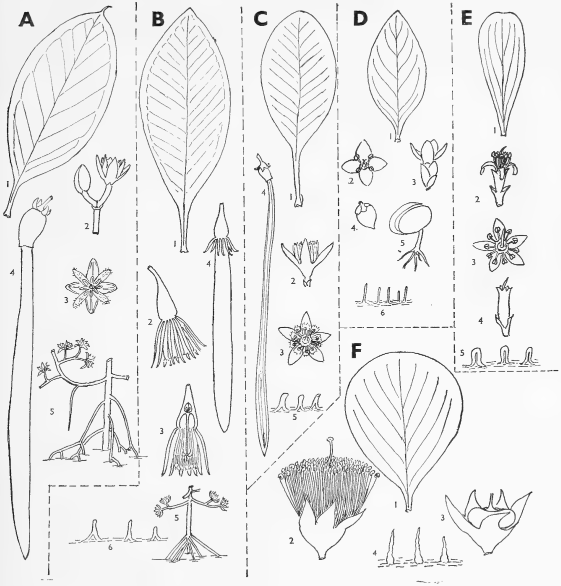

Plate 1

A. *Rhizophora mucronata* Lam. 1. leaf $\times \frac{1}{4}$; 2. flower and bud $\times$ 1; 3. flower $\times$ 1; 4. embryo $\times \frac{1}{4}$; stilt roots (diagrammatic).

B. *Bruguiera gymnorrhiza.* (L.) Lam. 1. leaf $\times \frac{1}{4}$; 2. flower $\times \frac{1}{2}$; 3. longitudina section of flower $\times \frac{1}{2}$; 4. embryo $\times \frac{1}{4}$; 5. buttress roots (diagrammatic); 6. pneumatophores (diagrammatic).

C. *Ceriops tagal* (Perr.) C. B. Robinson. 1. leaf $\times \frac{1}{4}$; 2, 3. flower $\times$ 1; 4. embryo $\times \frac{1}{4}$; 5. pneumatophores (diagrammatic).

D. *Avicennia marina.* (Forsk.) Vierh. 1. leaf $\times \frac{1}{2}$; 2, 3. flower $\times$ 2; 4. young fruit $\times \frac{1}{2}$; 5. embryo $\times \frac{1}{2}$; 6. pneumatophores (diagrammatic).

E. *Lumnitzera racemosa.* Willd. 1. leaf $\times \frac{1}{2}$; 2, 3. flower $\times$ 2; 4. young fruit $\times$ 1; pneumatophores (diagrammatic).

F. *Sonneratia alba.* Sm. 1. leaf $\times \frac{1}{2}$; 2. flower $\times \frac{1}{2}$; 3. young fruit $\times \frac{1}{2}$; 4. pneumatophores (diagrammatic).

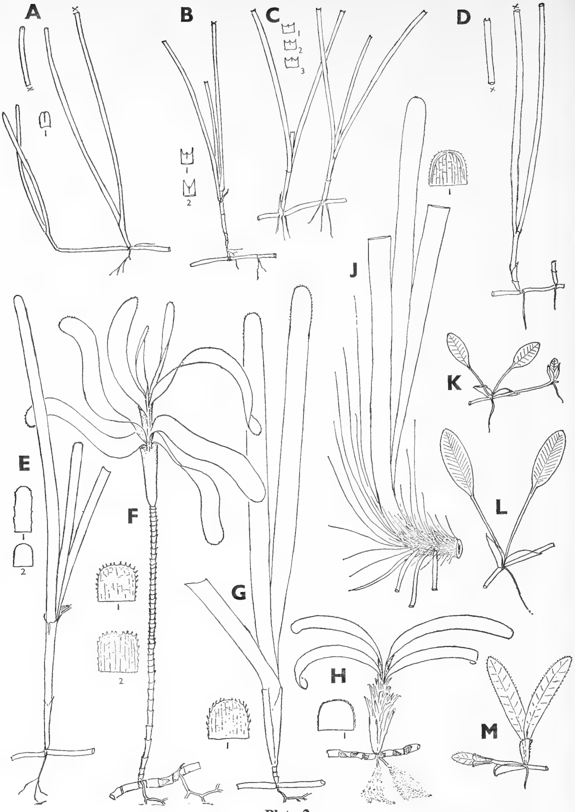

Plate 2

A. *Zostera capensis* × 1; 1. leaf tip × 2;
B. *Halodule wrightii* × 1; 1, 2. leaf tip variations × 4;
C. *H. uninervis* × ½; 1, 2, 3. leaf tip variations × 2;
D. *Syringodium isoetifolium* × ½;
E. *Cymodocea rotundata* ½, young leaf tip slightly toothed × 1; 2. mature leaf tip with entire margin × 1;
F. *C. ciliata* × ½; 1. young leaf tip × 1; 2. mature leaf tip × 1;
G. *C. serrulata* × ½; 1, leaf tip × 1;
H. *Thalassia hemprichii* × ½; 1. young leaf tip × 1;
J. *Enhalus acoroides* × ½; young leaf tip × 1;
K. *Halophila minor* × 1;
L. *H. ovalis* × ½;
M. *H. balfourii* × ½.
del. F.M. 1.

In most places along the coast *Cymodocea serrulata* (Plate 2,G), *C. rotundata* (Plate 2,E) and *Syringodium isoetifolium* (Plate 2,D) are present, growing in and around pools and sometimes in beds in sheltered bays.

A third species of *Halophila*, namely *H. balfourii* (Plate 2,M), is found in pools and deeper water where it is never uncovered. This is much less abundant than any of the afore-mentioned species.

The rarest of the marine angiosperms on these coasts is *Enhalus acoroides* (Plate 2,J) so far only recorded from the Lamu region and Mida Creek where it grows in deep water away from the open sea. However, a bed of stunted plants was seen exposed on an old coral platform on Pate Island. *E. acoroides* has long tough strap-shaped leaves and a stout rhizome covered by the stiff bristle-like bases of old leaf margins. The rhizome is eaten by the people at Lamu and is know as *Mtimbi*.

Zostera capensis (Plate 2,A) has been found only in a few isolated localities and, since the genus usually occurs only in cold or cool temperate regions, it is surprising that it should grow at all on these shores.

Both leaves and stems of many of the marine angiosperms are frequently coated with a wide variety of both epiphytic algae and small marine animals.

Algae of sandy and muddy areas

The sandy and muddy areas do not have an extensive algal flora although locally, certain species may be common. Thus in the soft mud at Mokowe, *Avrainvillea* spp. and especially *A. amadelpha f. submersa* is common. In this area in July 1965 there were dense growths of *Caulerpa* spp. Large plants of *C. scalpelliformis* were common and numbers of plants were growing together; *C. sertularioides* was almost as common and plants of *C. racemosa* (Plate 5, G) and *C. verticillata* were also found. In March 1967 fewer Caulerpas were seen in this area. Growing out of the soft substratum were large plants of *Halimeda macroloba* (Plate 5, A) which was much more plentiful in March 1967 than in July 1965. Very common on stones, sticks etc. were clumps of large *Neomeris van-bosseae*. In this area also a fair number of plants of *Udotea orientalis* and *Gracilaria cacalia* were present as well as scattered individuals or clumps of a number of other species.

In some sandy areas shoreward of the reef at the southern end of Diani Beach large numbers of scattered plants of *Halimeda macroloba* occur. In sandy areas of the Silversands reef (Malindi) also, scattered plants of this species are a feature some distance away from the reef edge.

Regarding algae found both on the reef and in the area to seaward of mangrove, one feature deserves special mention. Plants of the same species growing in mangrove mud may be fewer in number but individuals are larger and more luxuriant. This is often the case with *Padina commersonii*, *Gracilaria cacalia* and *Caulerpa scalpelliformis* as found at Gazi towards the southern end of the Kenya coast.

Algae of Rocky Platforms

PHAEOPHYTA (*Brown Algae*)

On some rocky platforms these are prominent, more especially species of Fucales and Dictyotales.

FUCALES. In places (e.g. parts of the shore of Manda Toto Island, parts of Diani Beach) emersed dwarf *Cystoseira myrica* forms a sparse cover together with the superficially similar brownish coloured *Laurencia papillosa* (Red Alga). Luxuriant forms of *Cystoseira myrica* bearing numerous small bladders occur in deep pools and at, and beyond, low water of spring tides. There may be elsewhere local concentrations, partly in and partly out of water, of *Hormophysa triquetra*. The genus *Turbinaria* is both ubiquitous and common and plants are often prominent, occurring at varying distances from low water level and may be uncovered, partly covered or completely immersed in pools at low water.

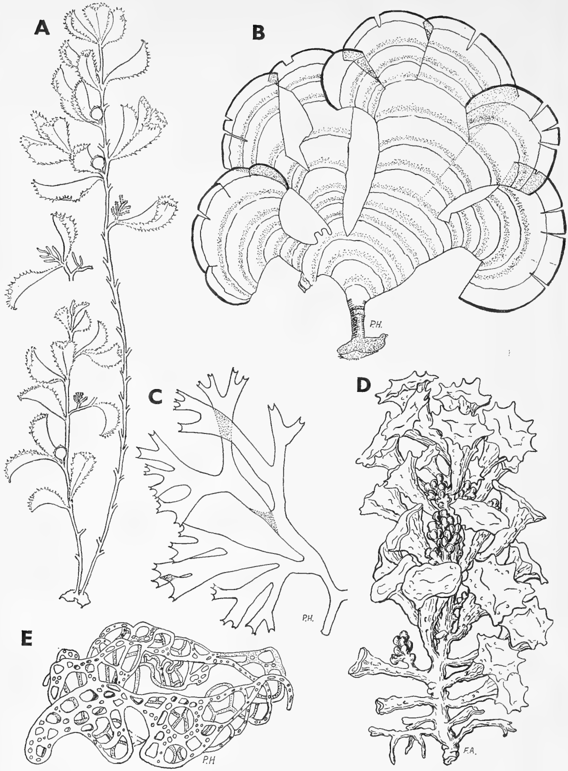

Plate 3

A. *Sargassum duplicatum* $\times \frac{1}{2}$;
B. *Padina commersoni* $\times 1$;
C. *Dictyota bartayresiana* $\times 2$;
D. *Turbinaria ornata* $\times 1\frac{1}{2}$;
E. *Hydroclathrus clathratus* $\times 1$.
A. del. F.M.I., D. F. Anderson, B.C.E. P. Hall.

One of the most widespread species is the variable *T. ornata* (Plate 3, D). In general they are lower on the shore than the *Cystoseira-Laurencia papillosa* communities referred to above. In other localities *Sargassum* ssp. of which *S. duplicatum* is illustrated, (Plate 3, A), are also very prominent, chiefly in pools or very shallow water, in which habitats they may be locally dominant. In large pools *Cystophyllum trinode* (*Cystoseira trinodis*) is sometimes a feature.

DICTYOTALES. *Padina gymnospora* and *P. commersonii* (Plate 3, B) are widespread over the reef, forming in places small, dense, local concentrations. In large shallow pools well away from the reef edge dense, extensive, almost pure communities of *P. commersonii* may be found as on the shore of Manda Island. Similar communities in similar habitats have been observed by us on Inhaca Island in Mozambique.

There are at least 5 species of *Dictyota* and these plants are sometimes common—they are certainly widespread. Although *Dictyota* plants may be found uncovered on the reef surface, they are mostly found in pools and frequently as epiphytes. One of the commonest species is the variable *D. bartayresiana* (Plate 3, C). *Dictyopteris delicatula* is a common and widespread species, a small plant and often not evident but on sorting collections it is found again and again as a constituent of clumps of small algae. *Stypopodium zonale* is widely spread at the lowest intertidal levels and in shallow water beyond low tide level of spring tides but it is not a common plant in such situations. Cast up plants are numerous, indicating that it is probably more abundant in deeper waters. Occasional plants of *Stoechospermum marginatum* (mostly small) have been found at various points along the coast. This species was found in abundance (fruiting) in August 1965 on the reef near Watamu village. At the southern end of this bay it was plentiful in a long 6 in.–1 ft. deep depressed channel through which sea-water was flowing rapidly at low water spring tide. The plants were in scattered clumps or growing singly. It was also found in still rock pools and to a limited extent completely emersed on the open platform. Large and small, repent and upright, dark and light coloured plants of *Pocockiella variegata* are widespread. They are often not readily seen since they may grow on low vertical faces or overhangs and in pools, sometimes as epiphytes.

Two species of PUNCTARIALES deserve mention here—*Colpomenia sinuosa* and *Hydroclathrus clathratus*, (Plate 3, E) more especially the latter which is not only widespread but is a common species on rocky platforms, e.g. at Diani Beach and Majuguni, Pate Island. Sometimes as on the Jadini bank at Diani at a little above low water level of neaps and well away from the open sea, it is at times a co-dominant with *Boodlea composita*, stunted *Cystoseira myrica* and *Laurencia papillosa*. The size of *Hydroclanthrus* varies from 9—over 15 cm. on the longer axis. *Colpomenia*, although widespread, is common only very locally and indidivudal plants may be of large size.

RHODOPHYTA (Red Algae)

In contrast to the coasts of South Africa (Isaac, 1953) Red Algae are not usually dominant in the intertidal areas of the Kenya coast but they are everywhere present in a less obtrusive form. In places at certain times *Liagora* spp. are common on uncovered rock surfaces of the lower shore as well as in pools as epiphytes. On ledges and flat surfaces exposed at low water and on shaded verticals high up the shore the beadlike clusters of *Acrocystis nana* (Plate 4, D) are locally common. *Gracilaria cacalia* and *G. crassa* (Plate 4, E) are common in places and the latter especially may be found uncovered at low water. *G. edulis* is common in higher level pools. *Acanthophora* is frequently a feature in water skins and pools of the upper levels, and in such localities *Hypnea valentiae* may also be found. Near low water levels *Carpopeltis maillardi* may be common. In the deeper low level pools *Actinotrichia fragilis*, *Galaxaura subverticillata* and *G. squalida* (Plate 4, F) may be fairly common. *Jania capillacea* frequently forms a dense cover on the axes of some of the larger brown algae and on *Cymodocea ciliata*. On Silversands reef clumps of *Amphiroa foliacea* several inches in diameter are locally a feature. Scattered in lower level pools and in shallow water beyond low tide level are plants of *Chondrococcus-hornemanni* and the similar but smaller *C. harveyi* (Plate 4, A) as well as *Halymenia venusta*. These, although widespread and moderately common, are conspicuous by virtue of their bright attractive colour and fleshy character and particularly in the case of *Halymenia*, the large size. Clumps of *Aman-*

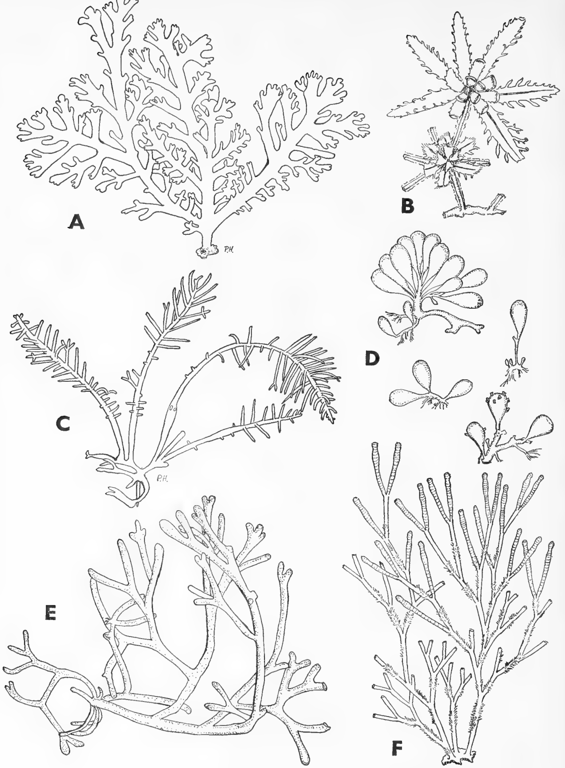

Plate 4

A. *Chondrococcus harveyi* × 2; B. *Amansia glomerata* × 1;
C. *Gelidiella acerosa* × 1; D. *Acrocystis nana* × 1;
E. *Gracilaria crassa* × 1; F. *Galaxaura squalida* × 1.

A.C.E. del. P. Hall.
B.D.F. del. F.M.I.

sia glomerata (Plate 4, B) are common in pools and at low levels often in turbulent water and frequently almost obscured by the heavy coat of epiphytic growth. At the same level *Neurymenia fraxinifolia* is found and like the foregoing species it is often host to plant and animal growths and presents a dirty appearance. The widespread *Gelidiella acerosa* (Plate 4, C) must also be mentioned. Filamentous forms of red algae are prominent in places. *Ceramium* is a frequent epiphyte; *Centroceras clavulatum* is widespread and has been observed as a common species on the south Diani beach in the proximity of inflowing water from the land; in the same place fairly extensive areas of *Polysiphonia ferulacea* have been observed on sand overlying rock. This species is also abundant on sandy areas on the landward side in parts of the outer reef at Diani.

The small beautiful, intricate lace-like *Vanvoorstia spectabilis* is common in places near the reef edge where it may form small compact clumps as on the shores at Majunguni, Pate Island. At Diani it is often a pale dirty pink or brown colour. The real beauty of this plant only becomes apparent when it is viewed under a dissecting microscope.

Digenea simplex is widely distributed in warm seas. It is not common on the south Kenya coast and when present is often so covered with epiphytes that it is not easily recognised. In the Lamu region the plant is more common and cleaner, and in places occurs in almost pure narrow stands well back from the sea. The plants observed were smaller than those found on Inhaca Island (Isaac 1956). In neither of these places is it as luxuriant or abundant as at Hurghada on the Red Sea.

Many more red algae might be named but enough have been listed to indicate that, with the exception of *Liagora*, *Gracilaria* spp. and *Laurencia papillosa*, although not usually a dominant ecological feature they represent a rich constituent of the intertidal flora.

An exception to the statement that red algae do not clearly dominate a given intertidal level on the Kenya coast is the case of *Bostrychia binderi*. On verticals and overhangs at the highest level of algal growth on cliffs along the beach this small moss-like alga is dominant and growing in close association in the mat which it forms are plants of the delicate small *Catanella opuntia*.

CYANOPHYTA (Blue-green Algae)

One species of blue green alga would seem to be ubiquitous on these shores—*Lyngbya majuscula*. It is very variable in size and is found on the rock surface at varying levels and occurs also as an epiphyte. The most striking occurrence of this species was an epiphyte on stumps and leaves of *Cymodocea ciliata*, of which there are extensive beds off shore at Majunguni (Pate Island). *Lyngbya* in dense clumps streamed out into the water like tresses of grey-black hair 15 cm. or more in length. Also widespread is the tufted *Symploca hydnoides*.

CHLOROPHYTA (Green Algae)

As is to be expected on a tropical shore there is a great wealth of green algae, especially species of the groups Siphonocladales and Siphonales.

Of the Ulvales there are a number of species of *Ulva* and of *Enteromorpha*. In places species of these genera form dense or extensive growths, especially *Ulva*. Thus *Ulva*, chiefly *U. lactuca*, dominates flat platforms just above low water neaps at North Cove, Diani Beach. It may also be mentioned that on a sand-mud admixture near mangrove at the north-west end of Lamu town, a dense and extensive community of *Ulva fasciata* was observed in July 1965. At levels nearer the sea on the south and central Kenya coast extensive growths of reticulate *Ulva*, including *U. reticulata*, occur commonly tangled with other algae and most often in rock pools. The smaller *U. rigida* (Plate 5, F) is ubiquitous along the coast at different shore levels, on uncovered or water skin covered platforms and in rock pools and not infrequently as an epiphyte. It does not, however, characteristically form extensive concentrations of individuals. By and large, *Enteromorpha* is less common than *Ulva* and dense extensive growths are uncommon and usually associated with an inflow of water from the land. At the North Cove end of Diani there are extensive growths of small *E. compressa* above the *Ulva* communities and below the areas dominated by *Bostrychia binderi*.

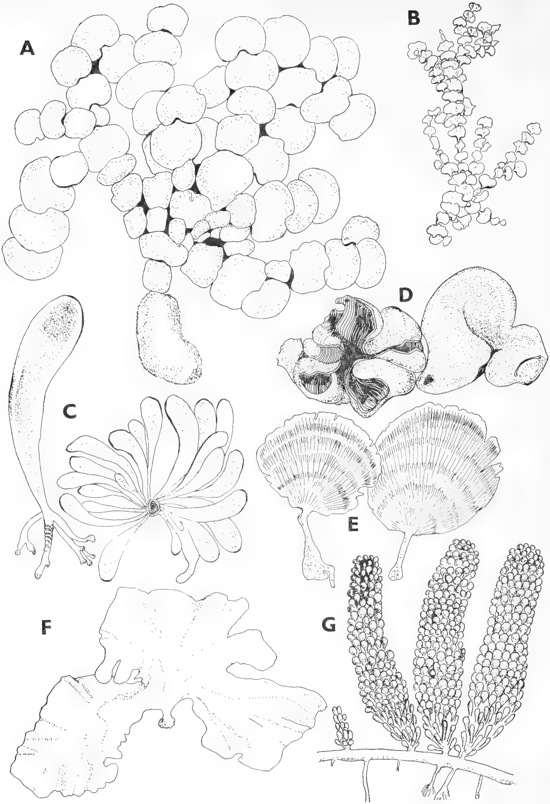

Plate 5

A. *Halimeda macroloba* × ½;
B. *Halimeda opuntia* × ½;
C. *Boergesenia forbesii* 1. single plant × 1; 2. cluster of plants, × 1;
D. *Dictyosphaeria cavernosa* × 1;
E. *Udotea indica* × 1;
F. *Ulva rigida* × 1;
G. *Caulerpa racemosa* × 1.

del. Mrs. P. Hall.

SIPHONOCLADALES—Widely scattered over the reef and most abundant nearer the open sea are low growing clumps of *Dictyosphaeria*, especially *D. cavernosa* (Plate 5, D) and *D. intermedia*. In water skins, depressions and pools further from the sea *Boergesenia forbesii* (Plate 5, C) may be a prominent feature as on parts of the coast of Manda Toto Island and near North Cove on Diani Beach. It is, however, a widespread feature of the reefs.

The following species tend to form clumps. At higher levels *Boodlea composita* may be common, extending upwards to above low water level of neaps. *Valoniopsis pachynema*, with or without an admixture of other species, occurs more commonly nearer the open sea. *Cladophoropsis membranacea* also occurs at different levels. In the Lamu area some more or less extensive clumps of *Ernodesmis verticillata* were observed at lower and intermediate levels.

Anadyomene is widespread and is sometimes fairly common. It occurs on uncovered reef in small sheltered depressions and in pools. *Struvea* is widespread as are also species of *Valonia*.

SIPHONALES—The most common are *Udotea*, *Halimeda* and *Caulerpa*. *Udotea indica* (Plate 5, E) is widely distributed on the reef varying considerably in size and character. It is sometimes very abundant. The larger lighter coloured *U. orientalis* is primarily a plant of quiet waters as in areas to seaward of mangrove. At least six species of *Halimeda* occur here. Of these *H. opuntia* (Pate 5, B) may form large sized masses in sand on the reef and elsewhere. These clumps may be almost completely buried in the sand. This is a feature shown by several species of *Halimeda*. The most outstanding exception is perhaps *H. macroloba* (Plate 5, A), the upper parts of which stand up clearly above the substratum. *H. tuna* is widespread at lower levels and in pools.

In the published lists of Kenya marine algae (Isaac, 1967, 1968) there are over 20 species and varieties of *Caulerpa* listed. Some of these such as *C. sertularioides*, *C. scalpelliformis*, *C. verticillata* and the very variable *C. racemosa* (Plate 5, G) are common and widespread. Others are less common and more characteristic of particular habitats. They will be dealt with more fully in a forthcoming paper. *Codium* is widespread but only very locally common, as for example *C. capitatum* in large pools at Shimo-la-Tewa. Brilliant green clumps and larger patches of *Chlorodesmis* may sometimes be extensive. *Avrainvillea* is a genus of sand and mud areas rather than of reefs.

Of the Dasycladales, *Neomeris van bosseae* is widespread and sometimes common.

CLADOPHORALES—There are several species of *Cladophora* and the genus is widely distributed on the Kenya coasts. *Chaetomorpha crassa* deserves mention as it often forms quite considerable 'balls of green string' usually entangled with other algae.

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MARINE BOTANY OF THE KENYA COAST
4. ANGIOSPERMS

By

FRANCES M. ISAAC
University College, Nairobi

ACKNOWLEDGEMENTS

The author acknowledges with thanks the generous financial assistance of the Rockefeller Foundation, Dr. C. den Hartog of the Rijksherbarium for identification of specimens; the British Museum of Natural History and Kew Herbarium for working facilities and the provision of photostat copies of literature which was not available in East Africa.

INTRODUCTION

Marine flowering plants are a prominent feature of the intertidal zone of the Kenya coast. They extend from the low water level of neap tides (i.e. they are rarely exposed except at spring tides) to situations well beyond the reef in deep water. Some are exposed for considerable periods during spring tides while others, although situated high on the shore, grow in pools and depressions where a certain amount of water is left by the receding tide.

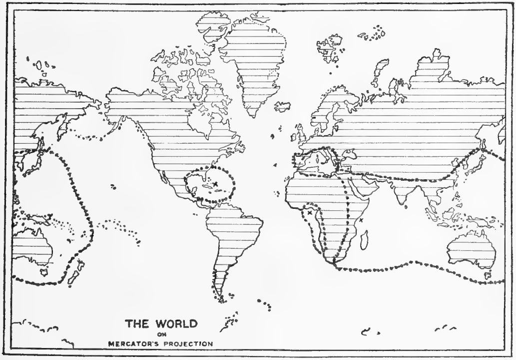

Fig. 1

Map showing World distribution of the marine forms of Potamogetonaceae and Hydrocharitaceae which occur on the coast of Kenya (with the exception of *Zostera*.)

These plants are frequently referred to in literature as "Sea Grasses". Only *Zostera* and *Halodule* however, on this coast, are grass-like in appearance.

The genera represented in Kenya all possess a creeping stem which may be on or near the surface of the mud or sand; these stems give rise at intervals to upright branches or leafy shoots and to a root system which anchors the plants firmly in the substratum. These stems may be slender and soft, thick and tough or woody.

The plants belong to the following families:— **Zosteraceae**, Zostera; **Potamogetonaceae**, Cymodocea, Syringodium, Halodule; **Hydrocharitaceae**, Halophila, Thalassia, Enhalus.

The pattern of distribution of these genera throughout the world is of considerable interest to botanists and plant geographers. These genera, with the exception of Zostera, occur only on the shores enclosed within the dotted lines on the map on page 29 (Fig. 1). The crosses on the map indicate *Halodule wrightii*, the only species which is common to East Africa, West Africa and the Caribbean.

Zostera grows on shores within the dotted lines shown in Fig. 2.

In a paper on the "Status of the Dugong", Jarman (1966) states that these animals feed exclusively on marine herbs of the Hydrocharitaceae and Potamogetonaceae. He mentions *Cymodocea rotundata*, *Halodule wrightii*, *Halophila ovalis* and *H. stipulacea* (*H. balfourii*) but omits *Syringodium isoetifolium* which according to Mr. Ian Prit-

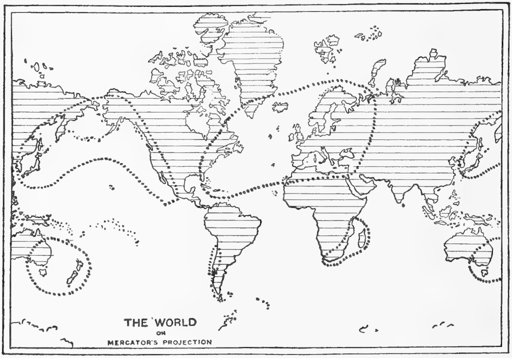

Fig. 2

Map showing World distribution of the genus *Zostera*. Only on the east coast of Africa is it found really in the tropics.

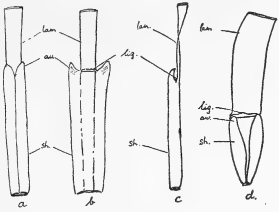

Fig. 3

chard, who observed the dugongs for a number of years, is a principal item in their diet.

In the following descriptions the terms sheath, ligule and auricle occur frequently in descriptions of leaves. The following illustrations will explain how these terms are applied. lam–lamina; lig.–ligule; au–auricle; sh.–sheath.

Halodule uninervis (Forsk.) Aschers. a. basal part of leaf b. sheath opened to show ligule c. side view.

Cymodocea ciliata Ehrenb. ex Aschers. d. basal part of leaf showing, infolded sheath and ligule.

Key to the Genera

1.	Leaves cylindrical	*Syringodium*
1'.	Leaves flat	2
2.	Leaves ovate, laceolate or linear, petiolate	*Halophila*
2'.	Leaves linear straplike without petioles	3
3.	Leaf apices toothed	*Halodule*
3'.	Leaf apices rounded	4
4.	Leaves up to 2 mm. broad	*Zostera*
4'.	Leaves more than 2 mm. broad	5
5.	Creeping stem woody more than 1 cm. in diam. and covered in long, stiff bristles .	*Enhalus*
5'.	Creeping stem woody or soft less than 1 cm. diam. with scales at nodes at least when young	6
6.	Leaves arising from a conspicuous upright stem	*Cymodocea*
6'.	Leaves arising from the creeping stem or on a short shoot there-from . . .	7
7.	Leaves usually falcate, shoot enclosed in a shaggy agglomeration of old leaf-bases ligule absent	*Thalassia*
7'	Leaves usually straight, leaf-bases if present, distinguishable as sheaths of former leaves with auricles and ligules	*Cymodocea*

Zostera capensis Setchell (Plate 1, a—c)

Plants monoecious. *Rhizome* slender creeping, rooting at nodes, 1–2 mm. in diam. *Leaves* sheathing; sheath open but incurved to enclose the younger leaves, 2–5 cm. long, auricles rounded; ligules short, delicate; lamina linear 8–20 cm. or more in length, 1–2 mm. broad, tip rounded, apex narrowly deep-notched, median vein fairly conspicuous. *Flowers* not found as yet on the Kenya coast but Setchell describes them as follows: "Flowers borne on a short erect stem 5–9 cm. high, 3–4 internodes, spathe twice as broad as the peduncle; spadix 1–3 mm. broad, 10–15 mm. long, with about 7 flowers, retinaculi (bracts opposite the stamens) ovate-lanceolate, 1–1.5 mm. long, 0.5–1 mm. broad. *Seeds* about 2 mm. long, 1 mm. broad, broadly cylindrical in the dry state with about 20 fine grooves (when wet these are less distinct)".

WORLD DISTRIBUTION: South Africa and Mozambique. It has also been reported from Dar es Salaam.

KENYA: Lamu, Greenway & Rawlins 8902, F. M. Isaac A 187; Mombasa, F. M. Isaac A 105; Gazi, F. M. Isaac A 98.

Flowers have so far not been observed on the East African coast but Setchell's description of the type specimens of *Z. capensis* and a drawing of an inflorescence have been included so that collectors may be encouraged to seek them and having found them will have some help in interpreting them.

Descriptions of the nature of the inflorescence in *Zostera* are vague but Willis's Dictionary of Flowering Plants and Ferns (1960) is quoted:

"*Inflorescence* a flattened spadix, enclosed at flowering time in a spathe (the sheath of the uppermost leaf). This is open down one side and on the corresponding side of the spadix the flowers are borne, the essential organs forming two vertical rows, each composed of a carpel and a stamen alternately. On the outer side of the spadix next the stamens is often a small leaf (retinaculum). Each carpel contains one ovule and has two flat stigmas. The stamen consists of two half anthers, joined by a small connective. It is difficult to decide what is the actual 'flower' in this plant; the usual view is that each stamen with the carpel on the same level forms a flower, the retinaculum representing the bract. Flowers are submerged like the rest of the plant. The pollen grains are long threads of the same specific gravity as salt water so when discharged they float freely at any level. The stigmas are large and have a good chance of catching some of the grains.

"The flowers are protogynous, i.e. the stigmas are receptive in any given spadix before the anthers are ripe and ready to shed pollen."

This genus is, in general, found in cold or cool temperate regions. Thus its occurrence in the tropical waters of East Africa is of considerable interest. So far it has only been found in the ports of Lamu and Mombasa and at Gazi, which is an ancient port, hence the possibility that it has been carried in by ships cannot be completely overlooked.

Cymodocea Konig

This genus is at present under revision. Dr. den Hartog of the Rijksherbarium considers that *C. ciliata* belongs to a distinct and as yet unpublished genus. The author would also place *C. serrulata* in this new genus. So little is known about the floral structure of *C. rotundata* that no suggestions can be made at this stage. *Cymodocea nodosa* which is found in the Mediterranean appears to be quite distinct in many respects from both *C. ciliata* and *C. serrulata*.

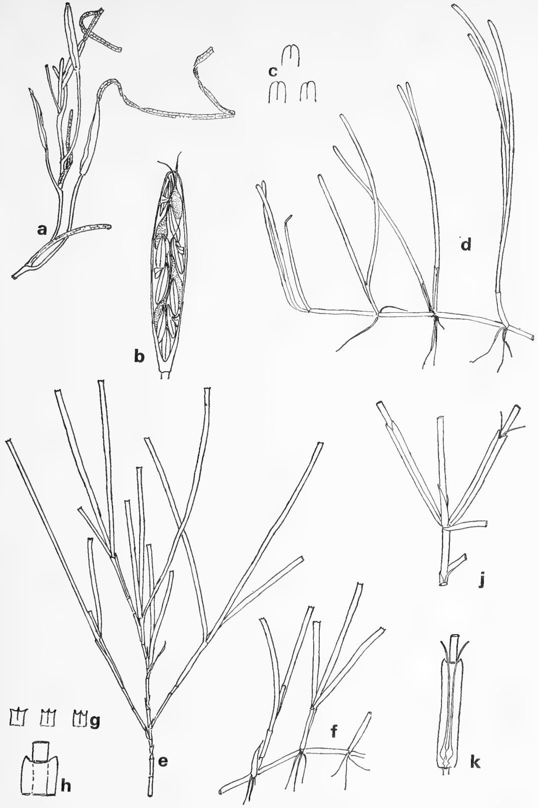

Plate 1

Zostera capensis Setchell a. portion of plant with inflorescences × 1; b. inflorescence × 2; c. leaf tips showing variation × 4; d. plant showing habit × 1; a & b were taken from drawings made by Miss J. McGillivray. e. *Halodule uninervis* (Forsk.) Aschers.—deep water form × ½; f. shallow water form × ½; g. Halodule uninervis leaf tips showing variation × 1; h. upper part sheath × 1; j. branch with female flower × 2; k. sheathing leaf base opened to show female flower × 2.

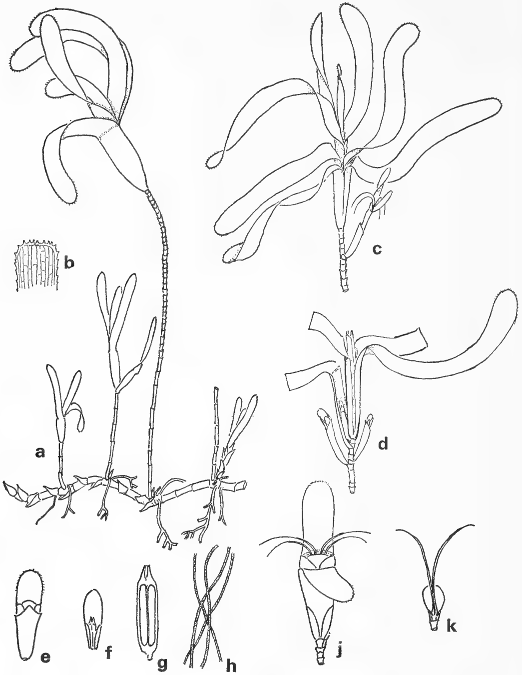

Plate 2

Cymodocea ciliata. Ehrenb. ex Aschers: a. plant $\times \frac{1}{2}$; b. leaf tip $\times$ 1; c. branch bearing female flower $\times \frac{1}{2}$; d. branch bearing male flower $\times \frac{1}{2}$; e. male flower $\times$ 1; f. bracts removed to show anther $\times$ 1; g. anther $\times$ 2; h. pollen threads (greatly enlarged); j. female flower $\times$ 1; k. three outer bracts removed to show gynaecium $\times$ 1.

Key to the East African species of Cymodocea

1. Leaves borne on erect woody branches with conspicuous annular scars . . . . *ciliata*

1'. Leaves borne on short shoots close to the rhizome or rarely on branches of the rhizome which grow erect and bear leaves at the apex 2

2. Leaf apices markedly serrate at all times . . . . *serrulata*

2'. Leaf apices entire or only minutely and irregularly toothed in young stages . . *rotundata*

Cymodocea ciliata Ehrenb. ex Aschers. (Plate 2)

Plants dioecious. *Rhizomes* stout, woody 5–10 mm. in diam. with several wiry branching roots arising at a node; internodes 5–25 mm. long, becoming obscure on older rhizomes; scales broad, obtuse and blackish, adhering at the nodes on young rhizomes. *Branches* erect, usually 15–30 cm.—but often as much as 70 cm. high, woody, simple or branching, laterally compressed with conspicuous annular leaf scars. *Leaves* 5–7 at the apex of a branch, opposite, arising on the flattened axis of the stem; sheathing bases often pinkish in colour, vaginate, fan shaped, the older enclosing the younger, 2–4 cm. long, 10–15 mm. broad at the apex; ligules conspicuous as a flap extending across the leaf at the junction between the sheath and the lamina; lamina ligulate, usually somewhat falcate, 5–12 cm. long, 10–15 mm. broad, apex obtuse or rounded, margin densely serrulate in the upper part. *Flowers.* Male and female flowers occur immediately below the terminal leaf tuft, sometimes the young flowers are subtended by the lower leaves which are shed as the flower matures. The female flower is borne on a short lateral branch. The young flower and the pedicel are enclosed in a sheathing bract (1) which usually persists throughout the life of the flower. *Pedicel* 5–7 mm. long bearing the 3 alternating sheathing bracts at its apex; bract 1 has a sheath but no lamina, bracts 2 and 3 have a short lamina, bract 4 is small at the onset of anthesis but grows rapidly after the flower matures. *Gynaecium* composed of two separate carpels which are situated on a flattened receptacle between bracts 3 and 4; ovaries oblong ovoid 0.5–0.7 mm. in diam., each containing a single pendulous ovule and each with a style 3–5 mm. long which bifurcates into two sigmas 3–4 cm. long which are curved and extruded, one pair on either side of the flower. After fertilization only one ovary develops in almost all the flowers examined. A few have been found with both ovaries equally developed but only one case has been seen where both fruits germinate. The mature fruit germinates within the flowers which remain attached to the plant. The young plant is released only when it has 4–6 leaves and a well developed adventitious root system (Isaac F.M. Unpublished paper). *The male flowers* are smaller than the female, sessile or subsessile. There are four sheathing bracts, the first is similar in form to the corresponding one in the female flower but narrower, the second and third have short green laminae, the fourth is extremely small and transparent and does not encircle the anther at the base. There are also two short transparent erect, hairlike structures on either side of the anther for which there seems to be no corresponding structure in the female flower. The solitary anther, surmounted by two incurved, beak-like processes is four-celled and dehisces, after it has been released from the flower by means of a vertical slit in each cell. The anthers are bright pink in colour. *Pollen* threadlike, clinging in ropey masses.

WORLD DISTRIBUTION: Arabia, Red Sea, East coast of Africa to Mozambique and an impoverished form has been recorded from the coast of Zululand, Madagascar, Réunion, Seychelles, Mauritius, Queensland.

KENYA: *Cymodocea ciliata* grows at most places along the coast. It extends from small beds of stunted plants in rock pools high on the shore into deeper water both inside the reef and beyond it. It is extremely abundant with plants reaching maximum size for these coasts at Majunguni off the

island of Pate (Lamu Archipelago) and also at Turtle Bay and Watamu where it forms dense undersea meadows and where the amount of debris, chiefly old leaves, which is deposited on the beach indicates the presence of vast beds off shore.

F. M. Isaac, Diani A134; Watamu A68; Rayner, Mombasa 293.

TANZANIA: Milne-Redhead & Taylor, Lindi, 7479; 7554.

ZANZIBAR: Greenway 1136.

Cymodocea serrulata (R. Br.) Aschers. (Plate 3)

Plants probably dioecious. *Rhizomes* usually fleshy but may become tough and somewhat woody with age, whitish usually mottled purple with one or more branching roots at the nodes; internodes 2–5 cm. long; at certain times, perhaps when flowers are produced, branches of the rhizome grow erect with one (rarely two) leafy shoots. These leafy shoots are usually at right angles to the erect portion of the rhizome which bears them and they also produce roots although no longer in contact with the sand. *Leaves* usually produced on short shoots on the rhizome proper; sheathing bases often bright pink in colour, obconical 2–3 cm. long, 1–1.2 cm. broad at the apex, auricles acute or subacute, the oldest leaf base from which the lamina has fallen usually encloses the other leaves in the shoot; ligule conspicuous at the junction of lamina and sheath, lamina ligulate straight or slightly curved 15–30 cm. long, 0.7–1.5 cm. broad, margins smooth except near the apex where there are widely spaced teeth at least in young leaves; apex rounded or sub-acute, rarely slightly emarginate. *Flowers* unknown except for one female flower found in flotsam at Diani Beach on Jan. 12th. 1967. This was on a short shoot on a portion of the rhizome. There was an old leaf base enclosing a normal leafy shoot at the apex of which was the flower. The flower comprised four bracts similar to those of *C. ciliata*, bract 1, without a lamina; bract 2, with a well developed ligulate lamina and a short sheathing base; bract 3, with a broad obovate lamina but no sheath; bract 4, small and undeveloped. *Gynaecium* 2 separate ovoid ovaries with styles bifurcating, all as in *C. ciliata* but somewhat larger and stouter and the styles relatively shorter.

WORLD DISTRIBUTION: Australia, Japan, Philippines, India, Ceylon, Red Sea, Seychelles, Mauritius, Madagascar, Mozambique.

KENYA: This species is to be found at most places along the coast.

C. serrulata is a plant of relatively quiet water and is found in beds in sheltered bays or fringing pools fairly high on the shore. It reaches its maximum size in creeks and inlets such as Mokowe, Mida Creek and Gazi.

F. M. Isaac, Mokowe A25; Gazi A 119, A 97; Shimo la Tewa 114.

Cymodocea rotundata Aschers. et Schweinf. (Plate 4, a, b)

Rhizome fleshy and rather brittle, becoming tougher with age. *Roots* arising at the nodes, branching. *Leaves* 2 or 3 in a shoot arising from the rhizomes. *Sheaths* 2–4 cm. long, 3–6 mm. broad, a few persisting after the laminae have dropped, auricles ovate-acute; lamina linear straight 10–30 cm. long, 3–6 mm. broad, margins entire when mature, slightly toothed when young, apex rounded or somewhat obtuse. *Flowers* not seen.

WORLD DISTRIBUTION: Japan, Philippines, Pacific Islands, Queensland, Australia, India, Madagascar, Mozambique.

KENYA: ubiquitous.

F. M. Isaac, Malindi A 144; Diani A 13; Greenway & Rawlins, Osine 9299.

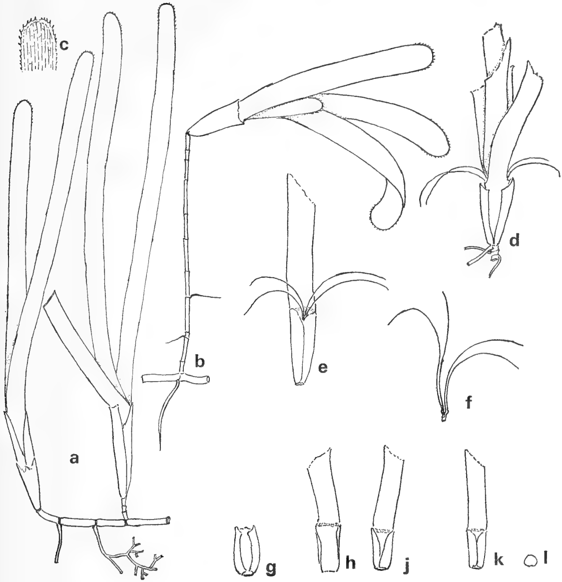

Plate 3

Cymodocea serrulata (R.Br.) Aschers. a. plant common form × ½; b. plant showing erect growth of rhizome bearing leaves, × ½; c. leaf tip × 1; d. shoot with female flower × 1; e. female flower with outer bracts removed × 1; f. gynaecium × 1; g. old leaf base × ½; h, j, k, l, flower bracts × ½.

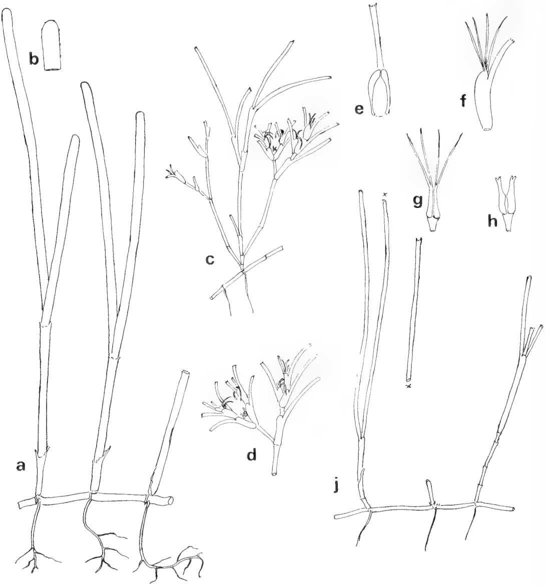

Plate 4

Cymodocea rotundata Aschers. & Schweinf. a. portion of plant × ½; b. young leaf tip × 1; *Syringodium isoetifolium*, (Aschers.) Dandy; c. plant with female inflorescence × ½; d. female inflorescence × 1; e. leaflike bract which encloses female flower × 3; f. female flower in bract side view × 3; g. gynaecium × 3; h. young fruits × 3; j. piece of plant showing leafy shoots × ½.

There is a record of male flowers and fruits having been found on the island of Timor but no description or illustration has been traced in literature. Thus it would be of considerable interest if flowers were found on the East African coasts where there are extensive growths of *C. rotundata*.

In appearance *C. rotundata* is often very similar to narrow-leafed forms of *Thalassia hemprichii* but the plants can be distinguished on closer examination by the presence in *Thalassia* of a mass of old leaf sheaths persisting at the base of a shoot. In *C. rotundata* persisting sheaths are few and widely spaced.

It is of interest to note that no trace of *C. rotundata* was seen in the Seychelles.

Syringodium Kuetz (Plate 4, c—j)

There are two species in this genus. The second species *S. filiforme* Kuetz is found on the coasts of Florida, the gulf of Mexico, the Caribbean, Bahamas and Bermuda where it is known as "manatee grass". This is of considerable interest since *S. isoetifolium* is said to be one of the favourite foods of the dugongs on the northern coast of Kenya.

Syringodium isoetifolium (Aschers.) Dandy

Plants dioecious. *Rhizome* creeping fleshy, brittle whitish 1.5–3 mm. in diam., internodes 1–2 cm. long. *Roots* usually simple but sometimes branching. *Branches* erect terete, with several internodes exposed near the base from which roots may arise, often the lower portion has persistent sheaths of leaves from which the lamina has fallen. *Leaves* distichous; sheaths long narrow, curving round to enclose the bases of the upper and younger leaves and the apex of the shoot, 1.5–2.5 cm. long, auricles broadly ovate, margins minutely fimbriate; lamina succulent terete 10–30 cm. long, 2–3 mm. in diam. tips when present, minutely toothed. *Female flowers* in a branching cymose inflorescence, each flower enclosed in a sheathing bract with a short leaf-like tip which drops as the flower matures, flowers pedicellate with two elongated ovaries 3–4 mm. long, 1 mm. in diam. at the base, tapering to the apex where each bifurcates to form two slender recurved styles 6–7 mm. long which protrude conspicuously from the sheathing bract. *Ovules* solitary attached to the inner facing walls of the ovaries. *Male flowers* not found by the author but according to Osterfeld they consist of a double stamen (anthers dorsally fused) in similar inflorescences and bracts to those of the female flower. (Osterfeld). WORLD DISTRIBUTION: New Caledonia, Australia, Mozambique, Indian Ocean.

KENYA: Widespread along the coast.

F. M. Isaac, Watamu A 93; Diani A 103.

TANZANIA: Drummond & Hemsley, Tanga 3315.

Inshore *S. isoetifolium* is found fringing pools, seldom in dense beds but there must be much denser growths in deeper water since, at times, large quantities of leaves and stems are washed up on the beaches. There are said to be extensive beds in places such as the mouth of Mida Creek where the dugongs feed on this plant.

Halodule Endl.

This genus has a number of species but only two have so far been found on the East African coast.

Key to Halodule

Leaf blade usually 1 mm. or more in width, lateral teeth not conspicuously longer than the median point . . . . *uninervis*

Leaf blade usually less than 1 mm. in width, lateral teeth conspicuously longer than the median point . . . . *wrightii*

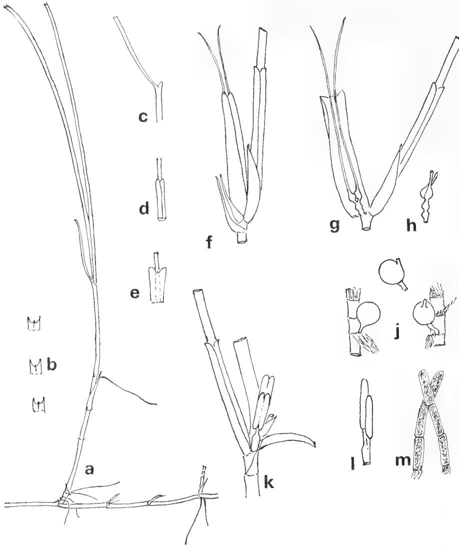

Plate 5

Halodule wrightii Aschers. a. piece of a plant × 1; b. leaftips showing variation × 2; c, d, e, leaf sheath × 1; f. shoot with female flower × 3; g. sheath open to show gynaecium × 3; h. ovaries side view × 3; j. fruits × 3; k. bract opened to show male flower × 3; l. stamens side view × 3; m. pollen chains (greatly enlarged).

H. uninervis (Forsk.) Aschers. (Plate 1, e—k)

Plants dioecious. *Rhizome* creeping, rather fleshy 1.5–2.5 mm. in diameter, 1–6 roots and an erect stem at the nodes. *Stems* usually short 1–5 cm. but in deep pools they may be 30 cm. or more with many branches and the leaves floating on the surface at low water; internodes 0.5–5 cm. long. *Scales*

elliptic, transparent and with an entire margin when young, becoming dark brown and ragged with age. *Leaf-sheaths* 1–3.5 cm. long, ligule inconspicuous. *Leaf-blade* linear, 10–15 cm. long, 1–3 mm. wide (rarely as narrow as 1 mm.), narrowed slightly to the junction with the sheath, usually straight rarely somewhat falcate; midrib more conspicuous in dried or preserved material than in the living plant; leaf-tip with 2 short lateral teeth and an obtusely rounded median tooth in which the mid-rib ends. *Female flower* 2.5–3 cm. long; ovaries long-ovate, 2 mm. long, style 2–2.5 cm. long apices extruded from the leaf sheath. *Male flower* and fruit not seen by the author.

WORLD DISTRIBUTION: Coasts of the Indian Ocean and Western Pacific. Coast of Africa from the Red Sea to Delagoa Bay. Madagascar, Seychelles Islands, Persian Gulf and Ceylon, Gulf of Siam, Japan, Malaysia, Australia and the Tonga Archipelago.

KENYA: Occurs at all places where collections were made.

F. M. Isaac, Diani A 9; Gazi A 77.

TANZANIA: Agnew, Dar es Salaam 8513.

H. uninervis as found in shallow water where it is rarely if ever exposed, is a plant with rather fleshy rhizomes giving rise at the nodes to short shoots with 2–3 leaves. No flowers have as yet been found on the shallow water plants. In creeks and deeper water the plants are more luxuriant with branching, almost woody upright stems and tougher, somewhat narrower leaves. It was on this form that female flowers were found at Gazi in August 1965. This form may be sufficiently distinct to be regarded as a variety when more information is available.

H. wrightii Aschers. (Plate 5)

Plants dioecious. *Rhizome* slender, creeping, brittle with several roots and a short stem at each node (in pools these stems may be long and branched); internodes 5–20 mm. long. *Scales* elliptic. *Leaf-sheaths* 12–20 mm. long ligule small and inconspicuous. *Leaf-blades* grass-like, 8–10 cm. long, rarely as much as 1 mm. in width; leaf-tips with two well developed lateral teeth; mid-rib blackish and conspicuous at the apex, usually produced to form a short point or small tooth. *Female flower* about 1.5 cm. long, ovaries ovoid, up to 1 mm. long, styles 1.2–1.4 cm. long, extruded from the leaf-sheath. *Male flower* 5–6 mm. long, the longer anther of the pair about 4 mm., the shorter 3 mm. long. *Pollen* threadlike. *Fruit* sphaerical blackish, about 2 mm. in diam., with the base of the style persisting.

WORLD DISTRIBUTION: Caribbean Islands, West Indies, Florida, Bermuda, Africa—East & West coasts, Madagascar, Mauritius, Persian Gulf.
KENYA: ubiquitous.

F. M. Isaac, Diani A 51, A 123, A 10; Malindi A 146. Greenway & Rawlins, Osine 9305.

TANZANIA: Agnew Dar es Salaam 8512

ZANZIBAR: Greenway 1130.

H. wrightii, sometimes in association with *Halophila ovalis* and *Halophila minor* is found higher on the shore than any of the other species considered in this paper. The plants of *H. wrightii* growing on sand highest on the shore have the narrowest leaves, and can withstand several hours of exposure to the air. Those in pools and shallow water are larger and more luxuriant in all respects. This species does not appear to grow lower on the shore than the low water level of spring tides.

The typical forms of *H. uninervis* and *H. wrightii* are readily distinguished by the character of their leaf-tips and the width of their leaves. There is, however, a multiplicity of intermediate forms which are difficult to assign to either species. These may have arisen as a result of hybridisation.

Halophila Du Petit-Thouars

Halophila is widely distributed and locally very abundant on the Kenya coast, where it is represented by three species. There is a specimen of *H. decipiens* Ostenf. in the East African Herbarium (M.C. 908)

which was found at a depth of 50 ft. off the coast of Zanzibar. This species, as well as *H. linearis* recorded for Mozambique, may possibly be found on the Kenya coast when more extensive search can be made.

Key to the species of Halophila

1.	Leaves ovate or linear, oblong with a slender petiole	2
1'.	Leaves linear elliptic, narrowed to the base but not markedly petiolate . .	*balfourii*
2.	Leaves with 3–8 pairs of cross veins ascending at an angle of 70–90° . . .	*.minor*
2'.	Leaves with 12–25 pairs of crossveins ascending at an angle of 45–60° .	*.ovalis*

H. ovalis (R. Br.) Hook. f. (Plate 6, a—g)

Plants dioecious—one monoecious plant was found indicating that the same plant may produce male and female flowers but not usually simultaneously. *Rhizomes* slender, internodes 1–5 cm. long. *Root*, one, unbranched produced at each node. *Scales* 2, 5–6 mm. long, transparent, sub-orbicular, apex emarginate, margin wavy or crinkled, slightly keeled and enclosing the leaf bases, new shoots and flower buds. *Leaves* one pair at each node, petiolate, blades oblong-elliptic to ovate, glabrous, 1–3 cm. long, 5–13 mm. broad; apex rounded or sub-apiculate, base rounded or decurrent into the petiole, margin entire, mid-rib and intramarginal nerves connected by 11–15 pairs of cross veins; petioles 1–7 cm. long. *Flowers* solitary, enclosed in two membranous bracts one embracing the other; bracts broadly ovate, apex sub-acute, 3–5 mm. long. *Male flower* pedicellate, pedicels 1–2.5 cm. long., perianth segments 3, ovate, cucullate, recurving strongly as soon as the flower opens, yellowish in colour, 3–4 mm. long, 2–3 mm. broad; anthers 3, 3–4 mm. long, erect, adhering, dehiscing longitudinally. Pollen in long chains. *Female flower* consists of an elliptic or long-ovate ovary 2–3 mm. long produced into a beak 3–10 mm. long bearing 3 rudimentary perianth segments and 3 styles, 10–25 mm. long. *Fruit* globular, smooth with the base of the style persisting. *Seeds* many.

WORLD DISTRIBUTION: South and East African Coasts, Madagascar, Red Sea, Malaysia, South Pacific, Australia, Tasmania and Japan.

KENYA: present in most places along the coast where conditions are suitable.

F. M. Isaac, Diani A 40; Watamu A 66.

ZANZIBAR: Oxtoby 908(a).

H. ovalis is found on mud exposed at low spring tides but more frequently in shallow pools and channels where it is only partially exposed or not exposed at all. It reaches its maximum size in such places. Flowers were found in July and August, the female flowers appearing before the males—only one collection was made when both sexes were found.

H. minor (Zoll.) Hartog. (Plate 6, h—p)

This species differs from *H. ovalis* in size, being smaller in all respects and in having a smaller number of cross-veins (6–8 pairs) connecting the mid-rib with the intra-marginal nerves. The angle between the mid-rib and the cross-vein is wider than in *H. ovalis*. Small forms of *H. ovalis* can readily be distinguished from *H. minor* on this feature.

WORLD DISTRIBUTION: India, Malaysia and East Africa.

KENYA: This species appears to be less common and has been found only in the Lamu area and Gazi.

F. M. Isaac, Mokowe A 100; Lamu A 22; Gazi A 116.

These were the first records of this species for the African coast.

H. minor occurs, often in association with *Halodule wrightii*, at the highest levels on the shore. It

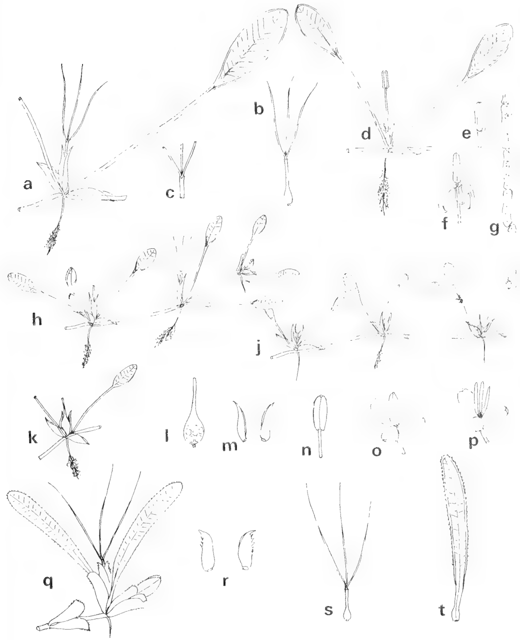

Plate 6

Halophila ovalis (R. Br.) Hook. f. a. portion of female plant × 1; b. gynaecium × 1; c. base of styles and corolla vestiges, × 2; d. male plant with bud × 1; e. bud × 2; f. bud open to show reflexed corolla and erect stamens × 2; g. pollen chain (greatly enlarged) *H. minor* (Zoll.) Hartog.; h. portion of female plant with young and old flower (in which stigmas have fallen) × 1; j. portion of male plant showing buds and open flower × 1; k. young fruit enclosed in bracts × 1; l. older fruit × 2; m. floral bracts which persist to enclose the young fruit × 2; n. stamen × 2; o. male flower × 2; p. male flower in which stamens have dehisced × 2; *H. balfourii* Solered. q. portion of plant with female flower × 1; r. floral bracts × 1; s. gynaecium × 1; t. leaf × 1.

seems less able to stand long exposure than *H. wrightii* and disappears at times to regenerate from the rhizomes when conditions are favourable.

H. balfourii Solered. (Plate 6, q—t)

Plants dioecious. *Rhizomes* thicker and more brittle than those of *H. ovalis* or *H. minor;* internodes 1–3 cm. long. *Scales* conspicuous, obovate, transparent, markedly emarginate, strongly keeled, usually toothed on either side of the apex and sometimes on the keel but otherwise margins smooth, 10–12 mm. long, 7–10 mm. broad. *Leaves* arising in pairs from a short stem which also bears flowers, linear-elliptic often slightly falcate, base attenuate with age, 2.5–8 cm. long, 4–6 mm. broad, margins serrulate, apex rounded, mid-rib and intramarginal veins well developed, cross-veins less conspicuous, leaf bases sheathing the apical bud and flower bud. *Male flowers* not seen. *Female flower* consists of 2 ovate, emarginate bracts with entire margins but a marked keel with an irregular series of upward pointing teeth on its outer surface. Ovary elliptic or long ovate, 2 mm. long, beak 3–5 mm. bearing 3 rudimentary perianth segments and 3 stigmas, 2–2.5 cm. long. *Fruit* and seeds not seen.

WORLD DISTRIBUTION: East Africa, Madagascar, Mauritius, Rodrigues.

KENYA: fairly widespread.

F. M. Isaac, Diani A 57; Shimo la Tewa A 108; Greenway & Rawlins, Osine 9325.

H. balfourii is less common than *H. ovalis* and tends to be local in its distribution. It is never completely exposed and only rarely found in very shallow water at low tide. Most frequently it is found at a depth of 2–3 ft. at low water spring tides. At times it is found in fair quantities in the debris on the shore at Diani and it seems reasonable to suppose that there are more extensive beds as yet undiscovered in deeper water.

This has been regarded by many authors as conspecific with *H. stipulacea* (Forsk.) Aschers. which is common in the Red Sea but having seen and collected both forms in their natural surroundings the author prefers to follow Solereder and regard the forms from East Africa and Madagascar as a distinct species.

Thalassia Banks ex Konig.

This genus comprises two species; one, *T. hemprichii*, is common in the tropical parts of the Indian Ocean and western Pacific, the other, *T. testudinum* Konig., occurs in the West Indies where it is known as "Turtlegrass".

T. hemprichii (Ehrenb.) Aschers. (Plate 7)

Plants dioecious. *Rhizome*, 5–6 mm. in diam. creeping, usually much branched, brittle and somewhat fleshy membranous scales at the nodes in the younger parts which fall to leave annular scars. *Roots* unbranched but densely covered with a mass of long fine hairs in which sand collects and which is easily detached from the roots. *Leaves* distichous usually falcate but almost straight in deep water, 2–6 in a shoot which is enclosed at the base by a coat of shaggy old leaf bases; lamina 4–40 cm. long, more usually 5–15 cm., 5–10 mm. broad, margin entire, apex rounded. *Inflorescences* pedunculate, 1-flowered, arising laterally between the leaves; peduncles up to 4 cm. long; spathal segments 2, lanceolate with sub-acute apices, connate at the base on both sides in the female, on one side only in the male. There may be one or two inflorescences on a male plant but they seem to appear singly on the female. *Flowers* with a floral tube 3–3.5 cm. long, bearing 3 elliptic cucullate perianth segments 10–11 mm. long and 2–3 mm. broad, reflexing and revolute at anthesis, rosy or brownish pink in colour. *Female flower* has 5–6 styles each forking 5–6 mm. from the base into a pair of spreading stigmas 7–10 mm. long. Ovary 1-celled imperfectly divided by cross septa. *Male flower* with 5–6 erect stamens up to 1 cm. long; pollen grains more or less spherical cohering in a gelatinous mass when released from the anthers. *Fruit* broadly conical, surface echinate with about four seeds.

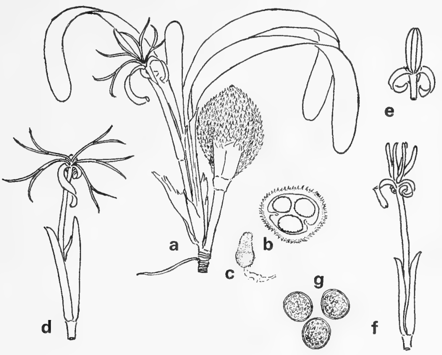

Plate 7

Thalassia hemprichii (Ehrenb.) Aschers. a. portion of plant showing female flower and almost mature fruit $\times \frac{1}{2}$; b. section of fruit $\times \frac{1}{2}$; c. ovule removed from fruit with gelatinous streamer $\times \frac{1}{2}$; d. female flower $\times$ 1; e. male flower with undehisced anthers $\times$ 1; f. male flower with anthers dehisced $\times$ 1; g. pollen grains $\times$ 100.

Thalassia hemprichii together with *Cymodocea ciliata* is perhaps the most widely spread and abundant angiosperm in Kenya coastal waters. Extensive beds of this plant often provide a base in which many algae and small animals are able to live.

It occurs fairly high on the shore where it may be exposed at low water springs and also extensively in deeper water between the shore and the reef. It has also been found in a luxuriant form in some of the creeks.

WORLD DISTRIBUTION: Indo-Pacific Oceans extending north to Japan.

KENYA: ubiquitous.

F. M. Isaac, Diani A 84; Mida Creek A 86; Malindi A 152.

TANZANIA: Milne-Redhead & Taylor, Lindi 7480.

Enhalus Rich.

This genus has only one species.

Enhalus acoroides (L.f.) Rich. ex Steud. (Plate 8)

Plants dioecious. *Rhizome* stout, branching 2–3 cm. in diam. densely covered with a fibrous coat of old leaf bases as well as stiff black bristles which are the remains of the marginal nerves of leaves. *Roots* unbranched, numerous, whitish, in appearance somewhat like the velamenous roots of orchids

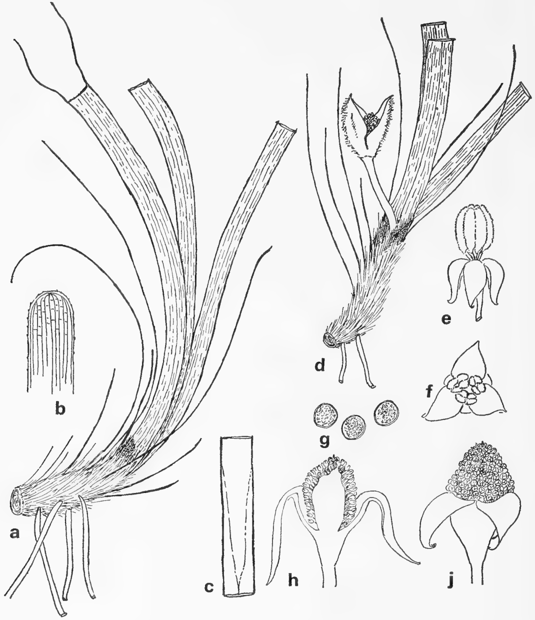

Plate 8

Enhalus acoroides (L.F.) Rich. ex Steud. a. portion of plant showing rhizome, leaf bases, bristles from old leaves, and fleshy roots $\times \frac{1}{2}$; b. leaf tip $\times$ 1; c. leaf base showing sheath and thickened margins $\times \frac{1}{2}$; d. rhizome with male inflorescence $\times \frac{1}{2}$; e, f, male flowers $\times$ 8; g. pollen grains $\times$ 100; h. section of young male inflorescence $\times$ 1; j. young male inflorescence $\times$ 1; in h & j. the involucral bracts were folded back to show the flowers arranged on a central cone.

3–5 mm. in diam. 7–20 cm. long. *Leaves*, 3–6 in a shoot, sheathing each other at the base, sheaths closed; lamina 30–100 cm. long, 15–25 mm. broad, tough in texture; apex rounded or obtuse; 11–13 parallel nerves, the marginal ones thickened towards the base. These marginal nerves form the ridges on the edges of the sheath, i.e. the infolded sheaths are lateral extensions of the lamina on the outer side of the marginal nerves. *Inflorescence* pedunculate with two spathe valves connate at the base. Female inflorescence (not as yet seen in Kenya), with a solitary flower with sepals 3, petals 3, a beaked ovary of 6 carpels unilocular with 6 pariental placentas protruding from the walls and forming 6 cavities; styles 6, each forked from the base; ovules many, each with 2 integuments, embedded in mucilage. *Fruit* ovate acuminate. *Seeds* 8–14, obconical, angular containing starch. The female inflorescence grows to the surface of the water and after the flower has been pollinated coils up to draw the developing ovary down into deeper water. The description of the female inflorescence has been taken from Flora Malesiana (Dr. C. den Hartog). *Male inflorescence*, unlike the female, remains submerged and the flowers break off the central axis and float up to the surface where pollination is effected; flowers many, massed in a cone, pedicels 2–10 mm. long with an abscission layer about 1 mm. from the apex; sepals 3, petals 3, ovate with incurved margins and cucullate apices, white tinged mauve, about 2 mm. long and 1 mm. broad reflexing at anthesis; stamens white, surface irregular, bullate, 1–2 mm. long. *Pollen* sphaerical as seen in anthers in bud.

WORLD DISTRIBUTION: *Enhalus acoroides* occurs in the tropical parts of the Indian Ocean—Madagascar, Seychelles, Red Sea, Ceylon, Nicobar & Andaman Islands; in Malaysia and Queensland and the tropical parts of the Western Pacific—the Solomon Islands and New Caledonia. It has only recently been recorded on the East African coast. (Greenway & Rawlins 1957 no. 9377 in the E. A. Herbarium).

KENYA: Lamu Archipelago, Mida Creek.

F. M. Isaac, Mokowe A 42, A 195; Greenway & Rawlins 9377; F. M. Isaac, Mida Creek A82.

TANZANIA: F. M. Isaac, Mafia Is. A 245.

It occurs in dense, pure stands in the channel at Mokowe and in Mida Creek. It is usually in fairly deep water, where only the upper parts of the leaves are visible but not fully exposed at low water spring tides, and where it roots in a muddy substratum. The older leaves are usually heavily encrusted with epiphytic organisms.

The rhizomes are eaten by people living in the Lamu area where the plant is known by the name of *Mtimbi*.

All the marine angiosperms act as hosts to a number of epiphytic algae as well as giving shelter to many small marine animals. It is proposed to deal with the aspect of the epiphytic algae in a subsequent paper.

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(*Received 28th November 1967*)

A FIRST BREEDING RECORD OF THE CUCKOO FALCON IN KENYA

By

L. H. Brown and G. Bursell

The Cuckoo Falcon, *Aviceda cuculoides* Swainson, is an uncommon, elusive, and little-known bird of prey which has never been thoroughly studied at the nest. Scanty West African observations indicate that it performs a vigorous tumbling and diving display, accompanied by calling and the exhibition of the chestnut underwing coverts; that the nest is probably built afresh annually; and that the incubation period was in one case about 33 days though, as the nest in question failed, this was not certain (J. H. Elgood, pers. comm., Brown & Amadon; in Press).

These observations accord with what is known of other members of this genus, which is commonest in India, Indonesia and Australia (3 species) and also occurs in Madagascar (1 species). The genus appears to be largely or entirely insectivorous and, perhaps for this reason, has the lores covered, resembling in this respect the Honey Buzzard *Pernis apivorus* (Linnaeus), which seems more closely related to *Aviceda* than any other Old World species of bird of prey.

There appear to be no breeding records of the Cuckoo Falcon in East Africa. None are listed by Mackworth Praed & Grant (1952), Jackson & Sclater (1938) or other standard works, and there are no eggs in the National Museum. When, therefore, the haunt of a pair was discovered in 1966 it was kept under observation in the hope of being able to record the breeding cycle. This proved impossible, but definite evidence of breeding was obtained.

The site was in a small relict patch of forest in a valley on a steep hill slope, surrounded by *Combretum-Hyparrhenia* savanna, at about 5,800 ft. alt. The pair had been seen by us in this area earlier, but no signs of breeding detected. On 8.1.67 G.B. observed a Cuckoo Falcon perched in the centre of the forest, with food in its beak. It flew to a dead branch of an *Albizia gummifera* (J. F. Gmel) C.A. Sm. growing at the lower end of the patch of forest. There it was joined by another, also with food in the beak. One bird disappeared into the dense part of the tree, reappeared without food, and flew away. The other remained on the branch, and since it appeared to be unwilling to go to the probable nest the area was then left undisturbed.

No nest was discovered on 22.1, though Cuckoo Falcons were seen and heard. On 12.2 a flimsy nest was found right in the leafy crown of the tree, perhaps 18 inches in diameter, and apparently made of vines, now dried. It was empty, but it is possible that the young had already left. Alternatively, breeding may have been a failure in 1966.

In late 1967 the nest site was kept under observation in the hope of watching the whole breeding cycle. No Cuckoo Falcons were seen until 4.11, when the female

(noticeably browner than the male) was seen flying to a dead branch near the nest, the same branch on which the pair had perched with food in January. She then went to the nest and the male, who had evidently been perched nearby, came to collect small green branches from a *Croton megalocarpus* Hutch. growing close to our observation point. We thus had a grandstand view of his building procedure.

Between 10.25 and 10.59 hrs. he collected eight green twigs in rapid succession. In each case his procedure was nearly indentical. He flew from the nest and settled about the middle of, or low down in, the *Croton* (or in other Crotons nearby). He would then peer about, looking upwards and sideways, cocking his head this way and that, until he had selected a suitable twig. He would then fly *up* to it, sieze it in his feet and, hanging upside down, reach up with his beak and snip off the twig. As he fell away with the twig in his grasp he righted himself dexterously and flew to the dead branch near the nest. Here he transferred the green twig from feet to beak before making the final flight to the nest itself. The only variation in this procedure was when on one occasion he sidled along a branch like a parrot and snipped off a spray without flying up to it.

The male left the area of his own volition at 10.59, soaring away overhead. He was not disturbed by us. When he had gone we went to look at the nest, where we found the female building in the structure used in the previous year. She had been incorporating the green twigs into the edge of the structure and evidently building had begun some days before as there were other twigs with dry leaves on the edge of the nest. The nest was a very slight frail structure, now appearing not more than 9–10″ across, and without the green leaves in its lining would have been transparent. The head and tail of the female projected well over the edge. Nevertheless it was the same structure as used the year before, showing that on occasions Cuckoo Falcons use the same nest for more than one year.

At 12.35 the female was still on the nest. At 12.45 the male returned and recommenced building, bringing new twigs at 12.50, 12.52 and 12.56. On this occasion we watched the nest itself. The female remained there the whole time while the male fetched the material. The male arrived with each twig, all *Croton*, carried in his beak, as before, placed each on the edge of the structure, and worked it partly into place before leaving. The female then picked up the new twig and readjusted it more securely, in another place. When both birds were on the nest together they more than filled it. They uttered soft somewhat explosive whistling calls "*Pititiu*, *pititiu*", inaudible except at close range. The female turned round and round in the nest and remained there when the male again soared away at 12.58. Clearly she had not yet laid and was not incubating.

On 12.11 the female was found incubating by G.B., at 07.30–08.30 hrs. facing up valley. The whole of her tail and vent protruded over the nest edge. On 22.11 the female was incubating from 10.25–12.45; a fresh green branch had been added. The incubating female changed position at 10.50 and at 11.00 turned the eggs; at 11.15 she ate a small scrap of food lying on the nest. The male was not seen. From

these observations it seems likely that only the female incubates and that she is fed on the nest by the male, though longer periods of watching are needed to prove the point.

On 5.12, by which time we hoped the eggs would be near hatching, no adults were observed between 08.50 and 12.30. Evidently some mishap had occurred, and the pair had failed, perhaps for the second year in succession. Nevertheless these records establish the fact that attempts to breed were made, and that in this case the breeding season was in November-December, in the height of the more reliable of two annual rainfall seasons in the area concerned. Breeding during the rains, although unusual in raptors as a whole, would be quite appropriate in this insectivorous species.

The Cuckoo Falcon has "teeth" or indentations in the upper mandible which, in the Falconiformes, are only posessed by *Aviceda*, the South American genus *Harpagus*, and the true falcons of the genus *Falco*. In the highly predatory *Falco* the teeth are used to break the necks of large avian or mammalian prey. The possession of "teeth" superficially similar to those of *Falco* is presumably the reason for the vernacular name "Cuckoo Falcon", which is most inappropriate for an inoffensive insectivorous bird which resembles the highly predatory falcons in scarcely any other respect. It may be that such "teeth" are needed to cut or break up the larger insects; but they are not possessed by most insectivorous birds, such as flycatchers. The neat manner in which the male used his beak to snip off green sprays of *Croton* which, for a human being, would require quite a powerful wrench or twist to remove, at least suggests that the "teeth" of *Aviceda* may be used to cut off building material. More observations are, of course, needed to show that this is a regular habit in *A. cuculoides* and in the genus *Aviceda* as a whole.

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(Received 22nd January 1968)

A NEW BUSH VIPER

By

JAMES ASHE

(Curator, Nairobi Snake Park)

A new viper of the genus *Atheris* has recently been discovered near Mount Kenya. This form comes from East of the Rift Valley in Kenya where no representatives of this genus have been previously recorded, and differs sufficiently from other forms to merit recognition as a separate species.

The first snake of this kind, a female, was brought to Nairobi Snake Park by a Peace Corps Volunteer, Mr. F. De Saix. Two further females of this species were collected by the author while a number of subsequent specimens have been received from Mr. De Saix. The species is therefore named for him in recognition of this, and for his past co-operation in collecting reptiles for this museum.

HOLOTYPE ♀: National Museum, Nairobi, No. 1626. Collected near Chuka, Lat. 0°20'S. Long 37°.35'E. on the third of July 1967 in rain forest at an altitude of c. 1,600 metres by F. De Saix.

DIAGNOSIS

Atheris desaixi sp. nov.

Nearest to *Atheris chloroechis* (Schlegel) from Western Africa with which it *agrees* in having short heavily keeled scales. The upper margin of the rostral scale is highest at the centre and supports an even number of supra-rostral scales, and the superciliary scales are not enlarged. In both, the nasal scale is circular and entire or semi-divided. It *differs* in its mid-body scale rows being 24–26: in *A. chloroechis* 25–36. Ventral scales are 165–168: *A. chloroechis* 154–165. In *A. desaixi* the sub-caudals are 44–46 (44–53 when the male specimen is included) against 48–57 (48–63 when male included) in *A. chloroechis*. The keels on the upper part of the dorsum end before the end of the scales, while in *A. chloroechis* the keels terminate in the form of swellings at the posterior end of the scales. It is larger in size: of the six specimens of the new viper, three are over 640 mm. in length, whereas the maximum length in the case of *A. chloroechis* is quoted as 615 mm.

DESCRIPTION OF HOLOTYPE ♀: Rostral between twice and three times as broad as deep, the highest point at the centre, and surmounted by four scales, the outer ones being the largest. Eye separated from upper labials by two scales. Eleven scales across

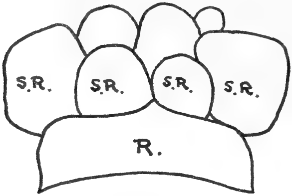


Fig. 1

Rostral arrangement of *Atheris desaixi*, Holotype
R = Rostral
SR = Supra-rostral

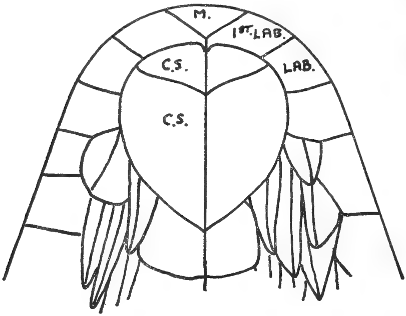


Fig. 2

Underside of Lower jaw of *Atheris desaixi*, Holotype.
Lab = Labial
M = Mental
C.S. = Chin Shield

occiput between eyes and 15 scales around orbit. Nasal circular, large and semi-divided, and pierced by a nostril in the centre. Nasal separated from eye by three scales, resting on first labial and separated from second by one scale. 11 left and 12 right upper labials, the anterior ones smooth and the posterior lightly keeled. All other head scales short and strongly keeled with the exception of those in front of the nasals, around eyes and chin shields which are smooth. Gulars strongly keeled, and in a series of nine from corner of last lower labials to chin shields. One small chin shield followed by a large one which in turn is followed by four small ones. First lower labial in contact with its fellow behind the mental. Dorsal scales strongly keeled, those on dorsum having foreshortened keels not reaching the end of the scale. The keels on the lower dorsal scales are serrated. Mid-body scale rows 24, ventrals 166, sub-caudals single and number 44.

COLOUR IN LIFE: Charcoal black with mustard yellow tip to each scale and festoon-like markings in the same yellow on either side of the dorsum bracketing the dorsal line. This patterning commences in an indistinct manner at the neck, but progresses to a clear pattern posteriorly until the tail, where it is indistinct again. The anterior half of the ventral surface is yellow. Beyond this faint purplish blotches begin to appear, which become progressively pronounced particularly on the rear edges of the ventral scales, until the vent. Tail beneath is a purplish black with the last few scales a blotchy yellow (the general shade of the series varies, but colours and markings are constant, the difference appears to be only in the amount of yellow in each scale).

ALLOTYPE: Male, National Museum, Nairobi, No. 1630, from same locality as holotype. Collected by Mr. F. De Saix on 1st October, 1967. The difference between this and the female holotype is as follows: anterior ventrals have a black posterior edge, the amount of black on these scales progressively increases until about three-quarters along the body where the whole ventral surface is black. This persists to the end of the tail which is a blotchy yellow. Ventrals 165, sub-caudals 53, tail into body length, a fraction over 6 times. In the female series the sub-caudal count is between 44–46, and the ventrals 166–168.

Holotype and Allotype to be deposited at the British Museum. One Paratype to the Museum of Comparative Zoology, Harvard, one Paratype to the Institut Royal des Sciences Naturelles de Belgique, Brussels, while the two remaining Paratypes will be retained at the National Museum, Nairobi.

DISCUSSION

In work on this snake at least one specimen of each of the series currently ascribed to *Atheris* was examined with the exception of *Atheris hispida* Laurent as in the description of this snake few of the characteristics coincide with those of *desaixi;* also no attempt was made to consider the two species recently removed from *Vipera,*

namely *A. hindii* (Boulenger) and *A. superciliaris* (Peters), due to the fact that they are atypical. Also *A. barbouri* (Loveridge) now occupies a new genus, *Adenorhinus* having been removed from *Atheris*.

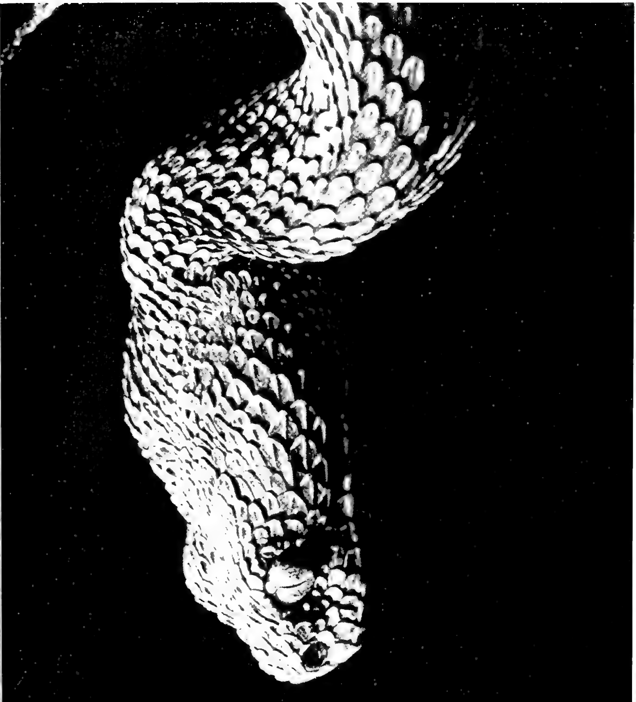
The rostral arrangement appears to divide the genus into two groups; in one a rostral scale with the highest point in the centre and an even number of supra-rostral scales, which is typical of *A. desaixi*, *A. chloroechis* and *A. ceratophorus* Werner; the other with a depressed centre to the rostral and an odd number of supra-rostrals as in *A. katangensis* Witte, *A. nitschei* Tournier, *A. squamiger* (Hallowell) and *A. hispida.** Further investigation may show justification in creating two-sub-genera based on this as a characteristic. Using this, and general morphology, the author believes that *A. chloroechis* is the closest ally of *A. desaixi.*

HABITAT: The first three specimens collected all came from an area of less than a mile across and at an approximate altitude of 1,600 metres. The first one came from a clearing with liberal undergrowth in rain-forest, and was discovered about 6 feet up a tree which was bare of leaves except at the top. The height of this tree was less than 15 feet. The second one was collected from a bush beside a pathway, and was noticed when creepers were being removed to keep the pathway clear. This one was about 5 feet from the ground. The camouflage of this reptile was perfect in these conditions, as the light green from the bush reflected from the yellow patterning, making the snake almost invisible even when it was entirely unconcealed. The third specimen was taken in less tall forest than the usual rain forest on a slope down to a small river. It was about 7 feet up in the canopy of an umbrella-shaped tree. There was almost no undergrowth, only very damp forest debris. No notes have been received yet of the other specimens collected. Both specimens collected by the author were taken at between 11.30 a.m. and noon.

OBSERVATIONS IN CAPTIVITY: These snakes fed in captivity, taking white laboratory mice. When alarmed they went into a display which resembled that of *Echis carinatus* (Schneider) in that they formed their bodies into loops and countermarched upon themselves, which causes a hissing sound. This was accompanied by rapid strikes towards the aggressor. This routine was indulged in with less enthusiasm than that of *Echis carinatus*. After a short time in captivity *A. desaixi* became quite mild, and would permit themselves to be handled with a hook without becoming unduly upset.

Whether this animal is nocturnal or diurnal is not settled. In captivity they show signs of both, feeding just as readily either by day or night.

* Although no specimens of *A. hispida* were examined, Laurent describes the supra-rostral arrangement as follows "*. . . surmontée de trois écailles dont la médiane est plus petite que les deux autres.*". This implies that this snake belongs to the second group.



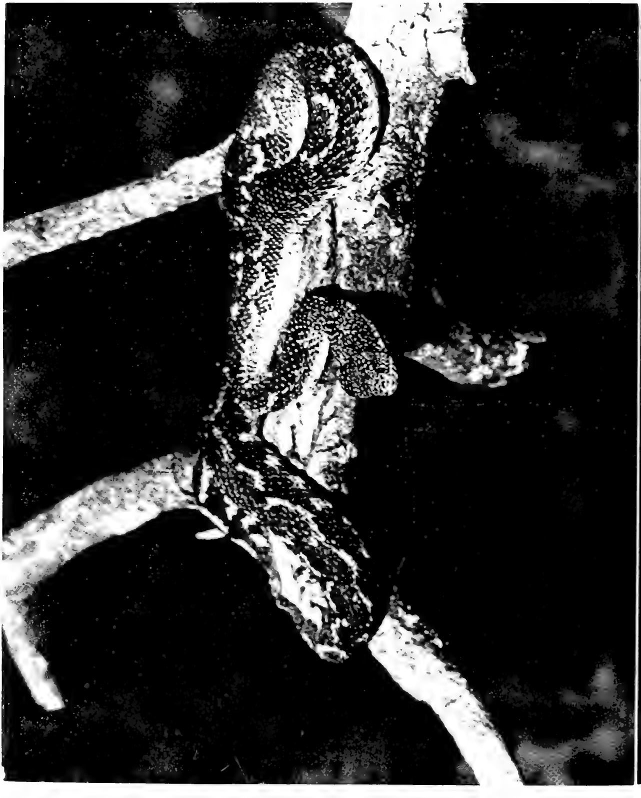


TABLE 1

	Holotype No. 1626 ♀	*Paratype* No. 1627 ♀	*Paratype* No. 1628 ♀	*Paratype* No. 1629 ♀	*Allotype* No. 1630 ♂	*Paratype* No. 1631 ♀	*Range*
Scales	L. R.	L. R.	L. R.	L. R.	L. R.	L. R.	
Upper labials	12–11	12–12	12–11	12–11	10–10	11–11	10–12
Lower labials	11–13	13–14	12–12	13–12	12–13	12–13	11–14
Round eye	15–15	16–17	15–15	14–14	15–15	16–16	14–17
Between eyes	11	8	11	11	11	9	8–11
Mid-body rows	24	26	25	26	24	26	24–26
Ventrals	166	168	168	168	165	168	165–168
Sub-caudals	44	46	46	45	53	46	44–46 (53♂)
Eye to Nasal	3	2	3	2	2	2	2–3
Eye to Labial	2	2	2	2	2	2	2
Measurements							
Total Length	645 mm	645 mm	682 mm	495 mm	555 mm	596 mm	495–682 mm
Length Head and Body	559 mm	556 mm	597 mm	431 mm	465 mm	512 mm	431–597 mm
Tail	86 mm	89 mm	85 mm	64 mm	90 mm	84 mm	64–90 mm
Collected by	F. De Saix	F. De Saix	J. Ashe	F. De Saix	F. De Saix	J. Ashe	
Date	July 3, 1967	Oct., 1967	Sept. 17, 1967	Oct., 1967	Oct., 1967	Sept. 19, 1967	

ACKNOWLEDGEMENTS

The author would like to extend his thanks to Mr. F. De Saix for bringing the first specimen of *Atheris desaixi* to the notice of this museum. Also to Mr. R. Poole, Director of United States Peace Corps in Kenya, for granting permission to one of his volunteers to collect reptiles.

Particular thanks are due also to Dr. Gaston F. de Witte of the Institut Royal des Sciences Naturelles de Belgique and to the British Museum for the loan of specimens.

The author is also greatly indebted to Capt. C. R. S. Pitman for supplying information, and for his assistance with the manuscript, also to Mr. R. Carcasson, Mr. A. Forbes-Watson and Mr. A. Duff-Mackay of the National Museum, and to Miss S. Swain of the Tigoni Primate Research Centre.

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(*Received 13th December 1967*).

REPORT ON BIRD RINGING IN EAST AFRICA FOR 1966–1967

By

G. C. Backhurst

INTRODUCTION

Earlier reports in this Journal have covered the period from 1960, when ringing started, to 30th June, 1966 (Blencowe, 1960 and 1962; Smart, 1966). The present report covers the year 1st July, 1966, to 30th June, 1967, except that certain local birds which were ringed in July 1966 (and were included by Smart, *loc. cit.*) are not counted in this year's totals.

It will be seen from the tables which follow that the present year was outstandingly good for ringing. John Smart, who left Kenya in April 1966, was responsible for much of the enthusiasm which made these results possible. His services will be greatly missed.

The year was also marked by the first recovery of an East African-ringed bird found outside East Africa.

The nomenclature used follows Vaurie for the Palaearctic birds and Mackworth-Praed & Grant for the African species.

Table I

BIRDS RINGED BY THE MEMBERS OF THE EAST AFRICA NATURAL HISTORY SOCIETY RINGING ORGANIZATION

a. Palaearctic Migrants

	1966/67	*Grand Total*
Garganey *Anas querquedula* L.	1	1
Ringed Plover *Charadrius hiaticula* L.	3	4
Mongolian Sand Plover *C. mongolus* Pallas	0	1
Great Sand Plover *C. leschenaultii* Lesson	1	2
Little Stint *Caldris minuta* (Leisler)	117	239
Temminck's Stint *C. temminckii* (Leisler)	1	1
Curlew Sandpiper *C. ferruginea* Pontoppidan	22	23
Ruff *Philomachus pugnax* (L.)	116	154
Marsh Sandpiper *Tringa stagnatilis* (Bechstein)	48	57
Greenshank *T. nebularia* (Gunnerus)	0	1
Wood Sandpiper *T. glareola* L.	4	12
Common Sandpiper *T. hypoleucos* L.	4	8
Sand Martin *Riparia riparia* (L.)	505	728
Swallow *Hirundo rustica* L.	332	563
Red-rumped Swallow *H. daurica* L. *	1	1
House Martin *Delichon urbica* (L.)	0	1
Tree Pipit *Anthus trivialis* L.	69	69
Red-throated Pipit *A. cervinus* (Pallas)	11	11
Yellow Wagtail *Motacilla flava* L.	2,965	3,687

Grey Wagtail *M. cinerea* Tunstall	0	1
Red-backed Shrike *Lanius collurio* L. †	21	26
Golden Oriole *Oriolus oriolus* (L.)	1	1
Sedge Warbler *Acrocephalus schoenobaenus* (L.)	115	128
Marsh Warbler *A. palustris* (Bechstein)	2	2
Reed Warbler *A. scirpaceus* (Herman)	115	119
Great Reed Warbler *A. arundinaceus* (L.) (*arundinaceus* & *zarudnyi*)	8	11
Basra Reed Warbler *A. a. griseldis* (Hartlaub)	2	2
Upcher's Warbler *Hippolais languida* (Hemprich & Ehrenberg)	0	2
Olivaceous Warbler *H. pallida* (Hemprich & Ehrenberg)	3	7
Barred Warbler *Sylvia nisoria* (Bechstein)	2	2
Garden Warbler *S. borin* (Boddaert)	118	141
Blackcap *S. atricapilla* (L.)	11	19
Whitethroat *S. communis* Lathum	4	6
Willow Warbler *Phylloscopus trochilus* (L.)	83	89
Spotted Flycatcher *Muscicapa striata* (Pallas)	1	2
Whinchat *Saxicola rubetra* (L.)	13	13
Wheatear *Oenanthe oenanthe* (L.)	0	3
Isabelline Wheatear *Oe. isabellina* (Temminck)	0	1
Rock Thrush *Monticola saxatilis* (L.)	1	2
Nightingale *Luscinia megarhynchos* Brehm	2	2
Sprosser *L. luscinia* (L.)	1	4
TOTALS	4,703	6,146

NOTES

* This bird was probably *not* a Palaearctic migrant

† Twenty birds were probably *L. c. collurio* or *L. c. kobylini*. The other bird was *L. c. phoenicuroides* (Schal.) or *L. c. isabellinus* Hemp. & Ehr.

b. African Birds

No list is given for this year as only one or two birds were ringed apart from those recorded by Smart in last year's totals. The grand total ringed stands at 960.

TABLE II

LIST OF RECOVERIES OF BIRDS RINGED IN EAST AFRICA

(This list refers to birds recovered during the 1966–1967 ringing year)

Key to symbols and terms

RING NUMBER: Where this is in italics the ring has been returned.

AGE: f.g. — full grown, age uncertain.
ad. — adult, at least one year old.

SEX: ♂ — male.
♀ — female.

MANNER OF RECOVERY:
\+ — shot or killed by man.
× — found dead or dying.

Red-knobbed Coot *Fulica cristata* Gmelin.

D.0503 Ringing details never supplied by ringer. J.G.

+(shot) 16.1.67. East side of Lake Naivasha, Kenya 0°45'S. 36°25'E.

Ruff *Philomachus pugnax* L.

B. 0700 f.g. ♀ 3.3.67 Lake Nakuru, Kenya 0°22'S. 36°05'E. — DJP
×(dead) 19.3.67 where ringed.

Yellow Wagtail *Motacilla flava* L.

J. 3809 f.g. ♀ 14.1.67 Eastleigh Sewage Works, Nairobi, Kenya 1°16'S. 36°52'E. — GCB
+(shot) 30.4.67 *near* Doha, Qatar, Persian Gulf c. 25°30'N. 52°E.

Yellow-bellied Greenbul *Chlorocichla flaviventris* Smith

A. 0720 f.g. ♀ 27.9.62 Manyara National Park, Tanganyika 3°35'S. 35°50'E. — AMM-D
+(shot) 27.2.67 where ringed.

Swallow *Hirundo rustica* L.

J. 2666 ad. ♀ 15.10.66 Eastleigh Sewage Works, Nairobi, Kenya — JBS
×(sick, died later) 16.10.66. Aquinas High School, Eastleigh area.

The above records constitute the only recoveries during the year.

TABLE III

BIRDS RINGED IN EAST AFRICA AND RETRAPPED IN 1966–1967 YEAR

Yellow Wagtail *Motacilla flava*

J. 006 24.9.61 Easteligh Sewage Works, Nairobi, retrapped 15.10.66 where ringed (♀)

Garden Warbler *Sylvia borin*

J. 1419 23.3.66 Gala, Uganda, 1°18'N. 31°49'E. retrapped 14.1.67 where ringed
J. 1426 31.3.66 Gala, Uganda, retrapped 18.12.66 where ringed, retrapped 6.4.67 where ringed

Reed Warbler *Acrocephalus scirpaceus*

J. 1405 18.3.66 Gala, Uganda, retrapped 25.2.67 where ringed
J. 1432 5.4.66 Gala, Uganda, retrapped 5.2.67 where ringed, retrapped 25.2.67 where ringed

Sedge Warbler *Acrocephalus schoenobaenus*

J. 1401 18.3.66 Gala, Uganda, retrapped 25.2.67 where ringed
J. 1408 19.3.66 Gala, Uganda, retrapped 22.3.67 where ringed

SOME NOTES ON RINGING IN EAST AFRICA

Only five ringers were operating in the whole of East Africa during the year. D. J. Pearson, based in Kampala, ringed over 1,700 birds mainly in Uganda but also a fair number at Lake Nakuru, Kenya. Besides most of the waders ringed in the year, Pearson also accounted for all the Whinchats and most of the warblers. D. J. M. Caffyn, working at Thika, caught good numbers of Yellow Wagtails and Swallows. E. D. Steel started ringing Yellow Wagtails in Nairobi towards the end of the season.

J. B. Smart and the writer worked together for much of the time, often with help from Society members. Eastleigh and Kariobangi Sewage Works, both on the eastern outskirts of Nairobi, were visited regularly from 24th September, 1966, until 9th April, 1967; Yellow Wagtails were caught in large numbers but numbers of other species were low. At Kabete, some eight miles north-west of Nairobi, over 650 Yellow Wagtails were caught. The birds were roosting in napier grass, *Pennisetum purpureum* Schumacher, over twenty feet high, but before going to roost they would gather around a certain herd of Hereford cattle some distance from the roost. The method employed was to flush the first arrivals away from the cattle into an adjoining cattle-free field where nets had been put up. Later arrivals would then settle in the "netting" field. Most of the birds would be sitting preening, a few would be feeding and generally the birds were fairly tame. When the time was considered ripe, the birds would be walked up towards the nets, the wagtails would fly or walk in the desired direction; then, when the ringers and helpers were about seventy yards from the nets, they would charge, and normally *some* birds would be caught. Providing that the net was not full of weavers or widow birds, it was usually possible to do more than one drive before the light failed. Sixty-nine Tree Pipits were also ringed at Kabete, most were caught in long grass in which they roosted.

Of the 659 Yellow Wagtails ringed at Kabete only one was retrapped there and none were retrapped elsewhere; a Thika Yellow Wagtail was retrapped at Eastleigh but no birds ringed at Eastleigh or Kariobangi were retrapped away from the place of ringing. The populations of wagtails at the different ringing sites were of considerably different sub-specific composition; at Eastleigh, Kariobangi and Thika most birds were *M.f. lutea;* at Kabete, *flava* was the commonest race, with small numbers of *lutea*, a few *thunbergi*, a *beema* and several resembling *cinereocapilla*. The Gala and Entebbe birds were mostly *flava* and *thunbergi*. Further quantitative work is planned on the racial composition of these different populations, also it is hoped that ringing will shed some light on the confused question as to whether or not the British race, *flavissima*, really does reach East Africa. It should be noted that racial identification is restricted to males.

The trapping of hirundines has not been possible on a large scale, mainly because no large roosts have been found. The ringing of warblers and small thrushes has only been worth while in Uganda; as recorded by Smart (1966) no satisfactory method or site has been found in Kenya for trapping reasonable numbers of these birds. Wader ringing at Lake Nakuru, Kenya, was shown to have good possibilities, and work is continuing at this site.

Once again the writer would like to appeal to any ringers or potential ringers to contact him to help in the Ringing Programme. Ringing does cost money but it is interesting to note that ring prices are lower than in Britain, and nets, pliers and balances cost the same as in Britain, plus postage.

ACKNOWLEDGEMENTS

Members of the East Africa Ringing Organization gratefully acknowledge the co-operation of the City Engineer, Nairobi, for allowing them to operate at the two sewage works; the Director of the Kenya National Parks for permission to ring at Lake Nakuru; and of the Director of Veterinary Services, Kenya, for permission to ring at Kabete.

Sincere thanks are also due to the following willing helpers: E. B. Bigwood, Miss E. J. Blencowe, I. Campbell, Mrs. L. Campbell, A. Forbes-Watson, Mrs. J. Hyland, Miss H. Irwin, J. McGhee, B. T. Parsons, Miss C. Parsons, J. F. Phillips, Mrs. M. Steel.

My wife has been of tremendous help to me throughout the year both with ringing and with administrative tasks. The MS. was typed by Miss A. J. Gittens.

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(*Received 8th December 1967*).

RECENT BREEDING RECORDS OF STORKS IN EASTERN AFRICA

By

M. P. Kahl

CONTENTS

INTRODUCTION

Between November 1963 and July 1967 I have been engaged in research on the comparative behaviour and ecology of storks (family Ciconiidae) in Kenya, Uganda, Tanzania, and Ethiopia. A number of previously unreported breeding localities were discovered during this study—some being found by me personally and others being reported to me by various correspondents. This paper is an attempt to compile the recent records, in the hope of giving a better understanding of the breeding distribution and breeding seasons of this family of birds. Storks frequently use the same nesting site for many years, if undisturbed and given the proper climatic conditions, and so perhaps these records will prove useful to future workers studying these birds. I have also included a few comments on the ecological factors involved in the timing of the breeding seasons, as a possible basis for further research along these lines.

RECENT BREEDING RECORDS OF STORKS IN EASTERN AFRICA

Species	*Location*	*Long.*	*Lat.*	*No. Nests*	*Date of First Eggs*	*Authority*
Yellow-billed Stork	**KENYA,**					
(*Ibis ibis*)	Kisumu (10km SE)	34°47'E	0°10'S	100+	mid-Mar 63	(1)
				50–65	early-Mar 64	(2)
				25	mid-Mar 65	(2)
				50–60	early-Apr 66	(2)
				50	late-Mar 67	(2)
	TANZANIA,					
	Chagana, River Wembere	33°55'E	4°30'S	2000+	Jan-Feb 62	(1)
	Lake Manyara Nat. Park	35°50'E	3°25'S	150	May 62	(3)

Species	Locality	Long.	Lat.	No.	Date	Ref.
Open-billed Stork (*Anastomus lamelligerus*)	**KENYA,**					
	Kisumu (10km SE)	34°47'E	0°10'S	20+	late-Mar 63	(1)
				70	early-Mar 64	(2)
	Garsen (8km S)	40°10'E	2°20'S	100+	June 56	(4)
	TANZANIA,					
	Chagana, River Wembere	33°55'E	4°30'S	5000+	Jan-Feb 62	(1)
	UGANDA,					
	Ishasha, Q.E. Nat. Park	29°40'E	0°35'S	8	mid-Dec 63	(2)
Abdim's Stork (*Sphenorhynchus abdimii*)	**KENYA,**					
	Busia, Sio River	34°08'E	0°20'N	1	mid-Jan 64	(2)
				1	late-Jan 65	(2)
				3	late-Jan 66	(5)
	Kisumu (town centre)	34°45'E	0°07'S	1	Feb or Mar 66	(6)
	Lokitaung (20km NW)	35°30'E	4°30'N	12	early-Jun 61	(7)
	ETHIOPIA,					
	Lake Shala	38°30'E	7°30'N	25–30	early-Apr 66	(8)
				45	early-Apr 67	(2)
	Gambella, Baro River	34°00'E	8°10'N	?	late-Mar 66	(9)
				?	Apr 67	(10)
Woolly-necked Stork (*Dissoura episcopus*)	**UGANDA,**					
	Murchison Falls Nat. Pk.	31°35'E	2°15'N	1	Nov-Dec 62	(11)
	Hoima (20km W)	31°10'E	1°30'N	1	Feb or Mar 64	(12)
				1	early Feb 65	(2)
Saddle-billed Stork (*Ephippiorhynchus senegalensis*)	**KENYA,**					
	Rumuruti (8km NE)	36°35'E	0°20'N	1	about Dec 62	(1)
	Kisumu (5km E)	34°47'E	0°07'S	1	mid-Mar 66	(2)
				1	early-Apr 67	(2)
	UGANDA,					
	Kazinga Channel, Q.E.Nat. Park	30°00'E	0°10'S	1	mid-May —	(13)
	Mweya, Q.E. Nat. Park	29°55'E	0°10'S	1	about Jun 65	(14)
	TANZANIA,					
	Seronera River, Serengeti	34°50'E	2°25'S	1	late-Feb 62	(13)
Marabou Stork (*Leptoptilos crumeniferus*)	**KENYA,**					
	Kitale (1km W)	35°00'E	1°02'N	?	Oct 62	(1)
				8	early-Oct 63	(1)
				15	late-Sep 64	(2)
				18	early-Oct 65	(2)
				18	mid-Sep 66	(2)
	Makindu (7km SW)	37°45'E	2°20'S	15	early-Jul 65	(2)

TANZANIA,					
Lake Manyara Nat. Park	35°50'E	3°25'S	8	Sep 58	(3)
			?	Jul-Aug 59	(3)
UGANDA,					
Hoima (20km S)	31°15'E	1°20'N	35	Nov-Dec 63	(2)
			80	mid-Nov 66	(2)
Chobe, Murchison Falls Nat. Park	32°10'E	2°15'N	5	late-Nov 66	(2)

AUTHORITY:

(1) M. E. W. North, *in litt.* (27 Nov 63)

(2) personal observations, M. P. Kahl

(3) A. M. Morgan-Davies, *in litt.* (10 Aug 65)

(4) North, 1959

(5) Z. Mwanga, *in litt.* (25 Jan 66)

(6) J. Blencowe, pers. comm.

(7) Blencowe, 1962

(8) E. K. Urban, *in litt.* (8 Jun 66)

(9) J. Blower, *in litt.* (22 Jul 66)

(10) E. K. Urban, *in litt.* (31 May 67)

(11) P. Allen, pers. comm.

(12) N. L. Howarth, *in litt.* (25 Jun 64)

(13) Pitman, 1965

(14) I. Ross, pers. comm.

RESUME OF BREEDING DISTRIBUTION AND SEASONS

YELLOW-BILLED STORK, *Ibis ibis* (Linné)

A wide-spread and commonly occurring species, which probably breeds in many more localities than those listed in the table.

At Kisumu, the only habitat where I have studied the ecology of this species in detail, reproductive activity appears to be triggered by heavy rainfall and the resultant flooding of the shallow marshes bordering Lake Victoria. This, in turn, seems correlated with food availability. The Yellow-billed Stork is primarily a fish-eater. During the dry season most fish are forced to leave the shallow marshes, which either dry up completely or become too de-oxygenated to support fish, and retreat to the deeper waters of Lake Victoria where they are unavailable to the birds. With the onset of the rains fish move up streams and spread out over the marshes of the Kano Plains to spawn. By nesting at this time the storks are assured a plentiful supply of fish for their young, provided the rains do not end prematurely.

The closely related Wood Stork (*Mycteria americana* Linné) in Florida, U.S.A., also breeds when fish are seasonally abundant. However, owing to different ecological circumstances, this happens to occur there during the dry season (*cf.* Kahl, 1964).

OPEN-BILLED STORK, *Anastomus lamelligerus* Temminck

Another widely occurring species, likely to be found breeding in low-lying areas where their major food, the *Pila* snail, is plentiful. All the available records from

eastern Africa seem to be from south of the equator, but certain areas in Uganda (such as the Lake Kyoga region) seem likely prospects for northern hemisphere breeding.

In most areas breeding seems clearly related to flooding and seasonal abundance of snails for food. *Pila* snails are known to burrow into the mud and aestivate during drought, emerging once again after the area has been re-flooded.

ABDIM'S STORK, *Sphenorhynchus abdimii* (Lichtenstein)

This small, insect-eating stork is found, often in great numbers, as a passage migrant over much of eastern Africa. Its main breeding grounds lie in the broad belt of semi-arid scrub savanna between 6° and 15° North, extending from Ethiopia and the Sudan across the continent to northern Nigeria and Senegal. In these regions Abdim's Storks nest commonly, sometimes abundantly, in trees, on rocks, and even on the roof-tops of village huts.

In East Africa proper they seem restricted, as breeding birds, to a small area of western Kenya in the vicinity of Kisumu-Busia-Kakamega. North (1940) has also reported their breeding in this region. (The breeding colony reported near Lokitaung, in extreme northern Kenya, is probably best considered a marginal representative of the main breeding population in the Sudan).

Throughout its major breeding range in the north, the Abdim's Stork nests during the long summer rains. It is everywhere known by the local people as a "harbinger of the rains", arriving about April or May as the rains begin and leaving once more for the south before the arrival of the dry weather. Their rainy-season breeding is probably related to the "flush" of insect food available for the young at that season.

In western Kenya breeding normally starts in January or February, between the short and long rains. This timing results in the young passing the period of greatest food demands and fledging during the long rains.

WOOLLY-NECKED STORK, *Dissoura episcopus* (Boddaert)

Rather rare everywhere but most often encountered in eastern Kenya and along the coast, or in the western Rift Valley in Uganda. Nesting is known only from western Uganda, but it may breed near Kilifi, Kenya (where the birds are often seen foraging on exposed reefs at low tide) or in the Tana River region.

Little is known of the type of food given to the young. Probably it is similar to that eaten by the adults—i.e. frogs, fish, snakes—and would probably be easier to find during or just after the rains. Woolly-necked Storks in India generally nest just before and during the monsoon.

SADDLE-BILLED STORK, *Ephippiorhynchus senegalensis* (Shaw)

This spectacular species is found throughout the region in the vicinity of large

marshes or lakes. It is a solitary nester, generally building its nest atop a large tree often some distance from water and usually remote from human habitation.

The birds are usually shy at the nest and will often desert if subjected to much disturbance by man. Thus, it was surprising to discover an active nest within 50 feet of the main Kisumu-Kericho highway, directly over a cluster of African huts and within easy sight and sound of passing traffic and pedestrians. These birds were amazingly tame and afforded ideal subjects for study during the 1966 and 1967 seasons.

In East Africa Saddle-bills breed mostly during the rains. At the Kisumu site the young were fed on large fish, procured in the marshes adjacent to Lake Victoria. As discussed under the Yellow-billed Stork, fish were abundantly available there only during the rainy season.

In other areas out of the equatorial belt (e.g. Zambia, Rhodesia, and the Sudan) most breeding occurs at the end of the single, long rainy season (Pitman, 1965). This could be related to the concentrating of fish in drying marshes as the water recedes, but firm ecological evidence on this hypothesis is still lacking.

MARABOU STORK, *Leptoptilos crumeniferus* (Lesson)

A discussion of the Marabou's breeding is presented in detail elsewhere (Kahl, 1966), so only a brief outline will be given here. Most nesting colonies are located near a dual source of food: (1) a supply of carrion to form the bulk of the diet, and (2) a source of fish, frogs, or other small vertebrates to fulfil the calcium requirements of the growing young. Although the Marabou is abundant in many places relatively few breeding sites are known, and these usually comprise only a few nests. Thus, it seems that the Marabou must breed only infrequently, on the average, and live a very long time.

Most breeding is confined to the dry season, for a number of possible reasons: (1) carrion is more readily available during drought when animals are concentrated in a few areas of remaining surface water, (2) aquatic vertebrates become concentrated and easier to catch in many habitats when water is receding, (3) some prey is caught at grass fires, which are common only during dry weather.

ACKNOWLEDGEMENTS

During 1964–65 these studies were supported by a post-doctoral fellowship from the U.S. National Science Foundation. During 1966–67 support was received from a research grant from the National Geographic Society, Washington, D.C. Additional financial aid came from the Chapman Fund of the American Museum of Natural History. I am grateful to Makerere College, where I was given working facilities during part of my study period, and to the following persons who assisted greatly by

supplying information: P. Allen, J. Blencowe, J. Blower, L. H. Brown, N. L. Howarth, A. M. Morgan-Davies, Z. Mwanga, M. E. W. North, C. R. S. Pitman, I. Ross, M. Turner, and E. K. Urban.

SUMMARY

A table of nesting records, most of them previously unpublished, is presented, showing breeding location, number of nests, and approximate date of egg-laying for the six species of storks (Ciconiidae) that nest in Kenya, Uganda, Tanzania, and Ethiopia.

A brief analysis of ecological factors related to the timing of the breeding season shows that most storks in this region adapt their date of egg-laying so that the young are being fed during the season of most plentiful food supply. In the breeding localities considered here the Yellow-billed, Open-billed, Abdmin's, and probably the Woolly-necked Storks rear their young during the rainy season. The Marabou Stork nests primarily during the dry season. The Saddle-billed Stork appears to nest during the rains in the equatorial belt of East Africa but at the end of the rains or during the dry season in Zambia, Rhodesia, and the Sudan.

It is hoped that this brief survey of stork breeding will stimulate further contributions to our knowledge of the breeding distribution of these birds and the ecological factors concerned in the regulation of their breeding seasons.

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(*Received 11th July 1967*).

BOOK REVIEW

The Ecology of the Alpine Zone of Mount Kenya by Malcolm James Coe, published in *Monographiae Biologica*, Vol. XVII, The Hague, 1967, pp. I-VIII and pp. 1–136, including a bibliography, an index occupying 6pp., 24 plates and 20 text figures. Price Dutch Guilders 25 or U.S. $ 6.95.

This account is based on work by Dr. Coe when he was included in the International Geophysical Year Mount Kenya Expedition under the leadership of Professor I. S. Leupekine.

All the field work was carried out on Mount Kenya between December 1957 and January 1963 and was used in part as a Ph.D. thesis of the University of London. Grants were made by the University College, Nairobi, to assist with porter and other expenses when visiting the mountain.

The author opens with a brief account of the history of the exploration of the mountain followed by an outline of the physiography, geology and glacial geology, particularly where they are relevant to the study of the ecology of the Alpine Zone.

The author's Alpine Zone of Mount Kenya ranges from 11,480ft. (3,500m.) to the lower limit of the Nival Zone along an ill-defined boundary at 14,760ft. (4,500m.) in the immediate vicinity of the glaciers and snow line.

Excluding the ubiquitous species of tussock grasses he says the dominant genera of plants in the alpine zone are *Senecio*, *Lobelia*, *Alchemilla* and *Helichrysum* and he uses them as important community indicators and goes on to describe the plants in some detail.

Under *Senecio* he lists three species of *Dendrosenecio*, four of *Eusenecio*, two Giant Lobelias, three species of *Alchemilla* and ten species of *Helichrysum*.

The author divides the vegetation into zones and communities, the latter based on terrain and he recognizes five zones.

1. Ericaceous (Moorland) Zone with three communities, a, Damp boggy ground, b, Raised rocky ridges, or old weathered moraines and c, Stream courses.
2. The Alpine Zone.
3. The Lower Alpine Zone with two communities, a, Flat or gently sloping ground, usually wet and b, Weathered and eroded ridge tops.
4. The Upper Alpine Zone with four communities, a, Valley walls, b, Valley floors, c, Ridge tops, and d, Lakes and Tarns.
5. The Nival Zone.

The Nival Zone was distinguished by the two Fries brothers, R. E. and Th. C. E. in their "Phytographical Researches on Mount Kenya and Mount Aberdare, British East Africa" (1948). They considered it a separate zone based on the disappearance of *Senecio keniodendron*, the lower limit of the zone is approximately 14,929ft. (4,550m.).

O. Hedberg in his "Vegetation Belts of the E. African Mountains" (1951), does not distinguish a separate zone at this level but included it in the Alpine Zone.

Coe considers the Nival Zone should be retained as a separate region on Mount Kenya as it is an area from which the glaciers have only recently retreated and upon which the earliest stages of vegetation colonisation are clearly discernable. He further states that "The plants forming the main association of this region are small in number, all stunted", and invariably growing in sheltered positions and in the order in which they occur appears to be quite specific.

The alpine climate is then dealt with; this covers temperature, rainfall, wind, climate and the alpine vegetation and he remarks that mountains on or near the Equator do not experience seasons like those mountains in the higher latitudes.

Comparable figures of temperature measurements are given for the Great Himalay, Mount Kenya and Kilimanjaro at about the same altitude, 4,000m., in this order, the Mean Maximum being 12.0°C, 5.4°C and 5.17°C., the Mean Minimum –1.5°C., –3.6°C., –0.77°C. and the lowest –10°C., –6.7°C. –4°C.

Comparable figures for rainfall, by means of a histograph for Kenya and a table for Kilimanjaro are given and the author draws a comparison to both mountains and says "These figures compare fairly closely with Mount Kenya with the annual precipitation rising sharply to a maximum at 8,000ft., and then falling off rapidly".

Further chapters cover the development and distribution of alpine soils including, 1, Soil generation, 2, The differentiation of alpine soil habitats, 3, The structure and chemistry of alpine soils.

Next Colonisation in the Alpine Zone, divided into two groups 1, Primary colonisation in the Alpine Zone, a, Colonisation of the Tyndall Glacier moraine, b, Colonisation of the Lewis Glacier moraine, c, Proglacial Tarns, and d, Dating moraine deposits, then 2, Other Phases of Colonisation.

The final chapter covers Biotic Factors in the Alpine Zone and this includes 1, Relations between animals, vegetation and habitats, 2, Herbivores and their relation to vegetation, covering a, Population size and control, and b, Breeding as a control factor.

The insects found in the Alpine Zones of Kenya and Kilimanjaro are mentioned. For herbivores in the Alpine Zone cycle of animal-vegetation balance the author lists the Hyrax, *Procavia johnstoni mackinderi*, the Grooved-toothed Rat, *Otomys orestes orestes* and the common Duiker, *Sylvicapra grimmia altivallis* and the author gives the Hyrax habitat in tussock grassland as being rocky and one which has been sufficiently weathered and eroded for them to become established, then below the tussock grassland the Otomys Rats live in the burrows they excavate at the bases of the Giant Senecios or in tussocks. The small number of Duiker occupying valleys in *Senecio keniondendron* forest with a more or less dense ground cover of *Alchemilla argyrophylla*. Mingling of the three communities only takes place when the Hyrax and Duiker leave their own habitats to go to water or when foraging in the Otomys habitat of the valley floor.

Food preferences of these three herbivores is discussed and the following avian residents, of which there are six with their food preferences are listed. They are the Scarlet Tufted Malachite Sunbird, Hill Chat, Streaky Seed-eater, Alpine Swift, Black Duck, and the Slender-billed Chestnut Winged Starling. Their territories range from 10,000 to 16,000 ft. except for the Black Duck which is found through the forest and Alpine Zone. Strangely enough there only appears to be one reptile, the Alpine Meadow Lizard, *Algyroides alleni*.

Other birds noted were Mackinders Owl, resident in the Alpine Zone, Augur Buzzard erratically resident, Verreaux Eagle, not common, observed breeding at 13,700 ft. in January 1958 and Lemmergyer resident in small numbers in the Alpine Zone.

Finally there is a discussion and the book ends with a summary and conclusions.

There are twenty photographs mostly of vegetation, two of Hyrax, and four of birds.

The author has given a very interesting account of the ecology of the Alpine Zone of Mount Kenya, its climate, soils, plants, herbivores and birds and one gets an idea of the extremes of temperatures and radiation under which the vegetation and its inhabitants have to survive. This is a book which every ecologist with an interest in the ecology of the plants and animals of our East African mountains should have on his bookshelf.

P.J.G.

MYLES E. W. NORTH

AN APPRECIATION

Although he had not been in good health for some time, the news of Myles North's sudden death on 24th November 1967, at the age of 59 came as a great shock. The East African Natural History Society has lost one of its most prominent and active members and his absence will be felt by all those friends who shared his interest in the wealth of bird life East Africa has to offer.

Myles was educated at Wellington and Sandhurst, with a view to making the army his career. However, after a brief trial, he decided that army life did not suit him and went to Cambridge. He graduated from Corpus Christi College and joined the Colonial Administration in Kenya.

His colonial service followed its normal course, interrupted by the war years when he was a Civil Affairs officer in Abyssinia and Somalia. At the time of his retirement from the Administration he was Director of Co-operative Societies in Kenya.

While members of the Natural History Society will remember Myles best for his leadership of rambles, and his lectures, the wider world of naturalists will remember him for his outstanding work on bird songs. In association with the Laboratory of Ornithology at Cornell University he was responsible for producing two remarkable long-playing records of East African bird songs. "Voices of African Birds" and "More Voices of African Birds" will always provide a fitting memorial to this remarkable personality.

But having said all this, I feel that I have failed to convey the essential Myles, with his sociability, his kindness to embryo ornithologists, his delight in the company of other naturalists and his meticulous attention to detail in everything he did and planned. His outstanding characteristic was perhaps his readiness to share with all the knowledge he had acquired after years of patient and diligent study and his enthusiasm evoked a corresponding response.

I first got to know Myles really well when he was working on the colony of Black-headed Herons breeding in the Nairobi Railway yards. This work made him very interested in photography and we had an arrangement by which he taught me about birds while I advised him on how to photograph them. I suspect that he was a better pupil than I was! And later, when my wife became interested in recording bird songs, Myles once again took infinite trouble to help and advise her.

Those of us who knew and loved Myles will always feel a gap in our lives at his going and will always remember him with deep affection.

J.S.K.

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JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. XXVII No. 2 (117) JULY 1968

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(Published 31/5/69)

Price Shs. 20/-

EAST AFRICA NATURAL HISTORY SOCIETY

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The Secretary, East Africa Natural History Society,
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THE ELOPOID AND CLUPEOID FISHES OF EAST AFRICAN COASTAL WATERS

by

G. F. Losse

(*East African Marine Fisheries Research Organization, Zanzibar**)

INTRODUCTION

Fishery statistics show that the herring-like fishes are among the most important in world fisheries of the present day (FAO, 1966). In East African waters, prior to the introduction of commercial pelagic fishing methods (EAMFRO, 1962; Losse, 1964, 1966), these fishes were exploited in very small quantities by a variety of indigenous fishing techniques, and virtually nothing was known of the species; their identity, biology or fishing potential.

During preliminary biological and fishery investigations of fish caught by introduced purse-seine fisheries in the Zanzibar area of East Africa, it was found that accurate descriptions of species were required before these studies could be accomplished successfully. A large collection of clupeoid fish was therefore made during the routine investigations of the East African Marine Fisheries Research Organization (EAMFRO) from March 1963 to June 1966.

Specimens were obtained from commercial purse-seine and stick-held dipnet (*bouke-ami*) catches taken in the Zanzibar Channel; also from catches made by indigenous fishermen with stake traps, castnets, shore-seines and hook and line, along the entire East African coast. Additional material was obtained from catches made by handnet, stick-held dipnet, seine, demersal trawling in estuaries and handlining, during cruises on the Organization's (EAMFRO) vessels R L CHERMIN and FRV MANIHINE. This material forms the basis of the descriptions in this paper, in which twenty-three distinct species, including two new distributional records, are described.

The biology of the species is still poorly known and little data is available on species of doubtful commercial value. Observations on the biology and fishery of the species are in preparation.

The present study could not have been completed without the examination of specimens from the clupeoid collection at the British Museum (Natural History) in London during the summer of 1964. The East African collection described here has now been donated to this museum.

MEASUREMENTS

Standard length and all other body measurements cited in the descriptions of clupeoid fish were made with dial calipers on preserved material.

Standard length (S.L.) is measured from the tip of the snout (jaws closed) to the caudal base. All measurements are expressed in percentages of standard length; *depth*, the depth of the body measured at the dorsal origin; *head*, the length from the snout tip (jaws closed) to the most posterior edge of the operculum, i.e. not necessarily a horizontal line; *snout*, *eye*, *post-orbital* measured in a horizontal line passing through the centre of the eye; *interorbital*, the bony inter-space between the eyes measured at eye centre; *upper jaw*, measured from the pre-maxillary symphysis to the posterior tip of the maxilla; *lower jaw*, measured from the dentary symphysis to the posterior border of the articular; *pectoral fin*, *pelvic fin*, the lengths of these fins measured

*Present address: c/o Department of Fisheries, FAO, Rome.

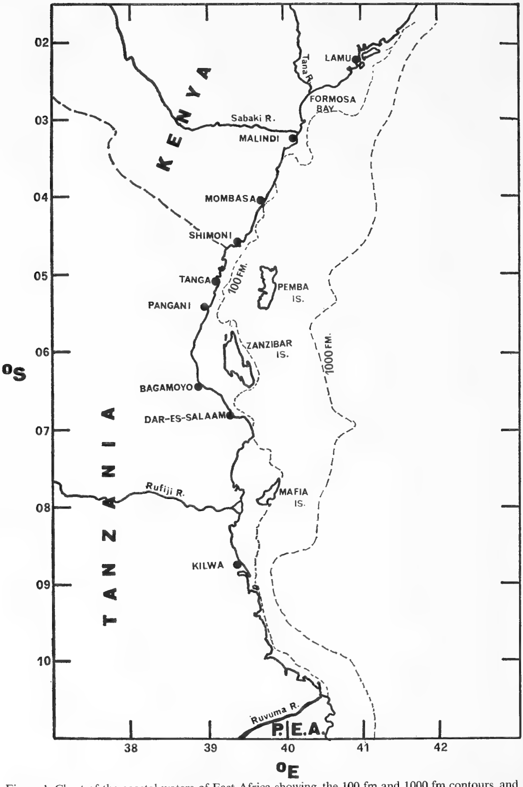


Figure 1 Chart of the coastal waters of East Africa showing the 100 fm and 1000 fm contours and the main localities mentioned in the text.

from the tip of the longest ray to the origin of the respective fins; *pre-dorsal, pre-pelvic, pre-anal,* these distances measured from the snout tip to the origin of the respective fins; *caudal peduncle,* the minimum depth at the base of the caudal fin.

In *fin counts* simple (unbranched) rays are represented by small (lower case) roman numerals and branched rays by arabic numerals. Spines are shown by large (upper case) roman numerals. In *ventral scute counts* the pre-pelvic count includes the pelvic scute; the first post-pelvic scute lies between the bases of the pelvic fins and lacks ascending arms (Whitehead, 1965b). *Lateral scales* or *scale pockets* are counted at mid-body from the operculum to the caudal base. *Vertebral counts* include the urostyle. Measurements and counts outside the normal ranges are placed in parenthesis.

NOMENCLATURE

Classification to family level is based on Whitehead (1963a).

In the synonymy reference is made to the original description, other subsequent records from East African waters and the more important literature from adjacent areas (i.e. from the Red Sea to Natal and the Oceanic islands); after the date of publication follow page numbers, plates, figures and localities.

Standard common names are introduced here for the first time. These are based on names frequently in use by fishery scientists and fishery officers in East Africa. Vernacular names follow their Swahili rendering and were obtained from the indigenous fishermen of the coast.

East Africa refers throughout only to the coast of Kenya and Tanzania and the offshore islands of Pemba, Zanzibar and Mafia (Fig. 1). Eastern Africa refers to the whole eastern side of the African continent, from the Red Sea to Natal.

Sub-order ELOPOIDEI

Key to the East African Families

1. Mouth terminal; upper jaw bordered by maxillae and pre-maxillae:
   (i) Last dorsal ray not filamentous; pseudobranch exposed . . . Family Elopidae
   (ii) Last dorsal ray filamentous; pseudobranch not exposed . . . Family Megalopidae
2. Mouth inferior; upper jaw bordered by pre-maxillae only . . . Family Albulidae

Family ELOPIDAE

TENPOUNDERS

A single genus widely distributed in tropical seas.

Genus ELOPS

Elops Linnaeus, 1766: 518 (Type: *Elops saurus* Linn.)
Argentina Forskal (*part.*), 1775: 68.

The genus has been revised by Regan (1909), Bertin (1944a) and Whitehead (1962). A single species in East African waters.

ELOPS MACHNATA (Forskal)

Plate 1a

Argentina machnata Forskal, 1775: 68 (Type locality: Djedda, Red Sea).
Elops machnata: Rüppell, 1835: (80) 74 (Red Sea); Günther, 1866: 121, fig. (caudal, Zanzibar); Sauvage, 1891: 497, pl. 49a, fig. 4 (Madagascar); Gilchrist & Thompson, 1917: 29 (references); Whitehead, 1962: 321 (Indo-Pacific specimens; revision all *spp.*); Losse, 1964: 12 (Zanzibar Channel); Whitehead 1965b: 231 (Red Sea, Gulf of Aden); Losse, 1966a: 89 (Zanzibar); *Idem,* 1966b: 167 (East Africa; Dar-es-Salaam, Zanzibar, Shimoni, Mombasa, Fundishu, Lamu); *Idem,* 1966c: 50 (Zanzibar Channel).
Elops saurus: Günther, 1868: 470 (East Africa, Zanzibar); Sauvage, 1891: 497, pl. 49a, fig. 4 (Madagascar); Boulenger, 1909: 25, fig. 17 (Zanzibar, East Africa); Gilchrist & Thompson, 1908–11: 270 (Natal); Gilchrist, 1913: 30, pl. 2 (Algoa Bay, East London, Delagoa Bay); Smith, 1949–1965: 86, fig. 100 (Natal); Baissac, 1951: 124 (Mauritius); Morrow, 1954: 803 (Kenya); Smith, 1955: 306 (Aldabra); Fourmanoir, 1957:5 (Madagascar); Smith, 1958: 131 (Inhaca, Mozambique); *Idem,* 1963: 8, pl. 44 (Seychelles); Talbot, 1965: 464 (Mafia).

STANDARD COMMON NAME: Tenpounder.
VERNACULAR NAMES: *Ganati* or *Mkami kuoza* (Malindi), *Munyimbi* (Shimoni), *Mkizi* (Zanzibar).
DESCRIPTION: Based on two fishes, 873–890 mm. standard length, from the Mafia Channel, eleven, 169–866 mm., from Zanzibar and one, 410 mm., from Lamu.

Dorsal 21-24 (3–4 of which are simple rays), pectoral i 15–17, pelvic i 12–14, anal 13–15 (2–3 of which are simple rays). Abdominal scutes and pelvic scute absent. Gillrakers 6–9+12–14, total 20–23 on 1st gill arch. The anterior rakers on the upper and lower arch are often reduced to low (movable) tubercles. Branchiostegal rays 29–33. Scales thin, small, firmly adherent, 86–106 in lateral series, plus 6–7 more on caudal. Pre-dorsal scales 43–44 (Mafia specimens), 13 above lateral line and 12 below. Vertebrae 60–63 (nine Zanzibar specimens).

Depth 15.2–20.1, head 18.4–27.2, snout 5.0–6.6, eye 3.9–5.9, post-orbital 12.5–13.9, inter-orbital 3.8–4.8, upper jaw 12.2–15.3, lower jaw 11.0–16.3, maxilla 9.3–12.9, pectoral fin 11.6–14.8, pelvic fin 10.2–14.8, pre-dorsal 49.1–55.3, pre-pelvic 44.5–55.7, pre-anal 76.0–81.7, gular plate, length 7.7–10.0, width 1.5–2.4, pectoral axillary scale 7.1–9.5, pelvic axillary scale 6.6–9.2.

Body elongate, scarcely compressed. Lower jaw variable; either included within the upper and not covering the anterior pre-maxillary toothband or projecting and covering part or whole of the pre-maxillary toothband; this character varied with size, the larger specimens possessing the longest jaws. Mouth large and terminal, scarcely inclined. Maxillary reaching beyond the posterior edge of the orbit. Teeth in villiform bands in jaws, on vomer, palatines and tongue. Gular plate large. Pseudobranch exposed. Adipose eye-lids broad. Lateral line straight with simple tubes. Anal fin far behind dorsal fin base; dorsal and anal fin with scaly sheaths, into which fins can fold completely. Last dorsal ray not elongated.
COLOUR: *Fresh*, dorsal scales bluish, their lateral and posterior borders black. Sides silvery, with a golden sheen or hue in death. Ventral surface white. Top of head dark brown to black with a greenish hue. A greenish spot in front of nares. Sides of head silver with a golden sheen. Black streak at upper posterior edge of operculum. Caudal fin dark brown to black, violet reflections at base. Anal and pelvic fins yellowish. Pectoral and pelvic axillary scales golden yellow, speckled brown.

In alcohol, dorsal surfaces dark brown to black, flanks silvery. Ventral surfaces white. Dorsal and anal fins dark brown, darkest (almost black) at margins, other fins brownish.
SIZE: 890 mm. S.L. (♀, 13 lb., Mafia Channel), weight 14 lb. (♂, 866 mm. S.L., Zanzibar Channel); average 30 in. and 30 lb. in South African seas (Smith, 1949).
DISTRIBUTION: Entire East African coast (recorded from the Mafia Channel, Dar-es-Salaam, Zanzibar, Shimoni, Mombasa, Malindi, Fundishu and Lamu), in estuaries, mangrove areas, lagoons and saline pools (Fundishu, Zanzibar); generally over a muddy or sandy bottom, often together with *Megalops cyprinoides*. The species was rarely found out to sea and apparently shows a preference for euryhaline conditions.
RANGE: Eastern coast of Africa from the Red Sea to Algoa Bay; Seychelles, Aldabra, Comores, Madagascar, Mauritius. Elsewhere, widespread throughout the Indian and Pacific oceans; East Indies, China, Japan and Hawaii (*E. hawaiensis* is known only from Hawaii and Australia).
REMARKS: Whitehead (1962) recognised two Indo-Pacific species, *E. machnata* (Forsk.) and *E. hawaiensis* Regan, distinguishing these on vertebral number (63-64 in *E. machnata* c.f. 68-70 in *E. hawaiensis*) and length of lower jaw (projecting and covering anterior part of pre-maxillary toothband in *E. machnata*, and included, with the whole of pre-maxillary toothband exposed in *E. hawaiensis*). Zanzibar specimens, which were examined, are characterised by a low vertebral count (60–63) and are therefore referable to *E. machnata*. The lower jaw character is, however, variable and cannot be relied upon in the identification of the species. Morrow (1954) referred a single specimen (1070 mm.) from Shimoni, Kenya, to *E. saurus*, stating that the ranges of meristic characters showed considerable overlap and that the specimen could therefore not be referred to any of Regan's (1909) species, although corresponding closest to *E. hawaiensis*. Other authors (Fowler, 1940; Smith, 1961) conservatively recognised but a single world-wide species, *E. saurus* Linn.

Future work on Indo-Pacific specimens may demonstrate that *E. machnata* and *E. hawaiensis* are not specifically distinct, but represent respectively western and eastern components (i.e. subspecies) of a single species.

Family MEGALOPIDAE

TARPONS

Genus MEGALOPS Lacepede, 1803

Megalops Lacépède, 1803: 380 (Type: *Megalops filamentosus* Lacépède = *Clupea cyprinoides* Broussonet).

A single species in the Indian Ocean.

MEGALOPS CYPRINOIDES (Broussonet)

Clupea cyprinoides Broussonet, 1782: (no pagination) pl. 9, (Type locality: oceans between tropics).
Megalops filamentosus: Lacépède, 1803: 289, 290, pl. 13, fig. 3 (Fort Dauphin, Madagascar); Fourmanoir, 1957: 5 (Madagascar).

Megalops indicus: Valenciennes, 1846: 388, pl. 542 (Madagascar, Mauritius).
Megalops setipinna: Bleeker, 1863: 345 (Madagascar).
Elops cyprinoides: Günther, 1966: 122 (East Africa); Martens 1869: 143 (Pangani River, Zanzibar).
Megalops cyprinoides: Günther, 1868: 47 (Zanzibar); Sauvage, 1891: 497, pl. 49a, fig. 3 (Madagascar); Gilchrist & Thompson, 1908–11: 270 (Natal); Boulenger ,1909: 28, fig. 19 (Zanzibar, Shire River); Gilchrist, 1913: 52 (references); Gilchrist & Thompson, 1917: 292 (references); Barnard, 1925: 104, fig. 11 (larva) (Natal); Smith, 1949–1965: 86, fig. 101 (South Africa); Baissac, 1951: 123 (Mauritius); Smith, 1955: 306 (Aldabra); *Idem*, 1958: 131 (Inhaca, Mozambique); *Idem*, 1963: 9, p.14E (Seychelles); Losse, 1964: 12 (Zanzibar Channel); *Idem*, 1966a: 89 (Zanzibar); *Idem*, 1966b: 168 (East Africa, Dar-es-Salaam, Zanzibar, Mombasa, Malindi); *Idem*, 1966c: 50 (Zanzibar Channel).
STANDARD COMMON NAME: Tarpon.
VERNACULAR NAMES: *Pawale* (general), *Kumpangu* (Malindi).
DESCRIPTION: Based on one fish, 413 mm. standard length, from the Mafia Channel; one, 173 mm., from Zanzibar; one, 480 mm., from Tanga and two, 293–373 mm., from Mombasa.

Dorsal iv–v 14–16, total 19–20, pectoral i 14–16, pelvic i 9–10, anal iii–iv 22–23 (25), total 26–27 (28). Gillrakers 14–16+29–33, total 43–49 on 1st gill arch. Scales firmly adherent, cycloid and very large, 34–36 in lateral series, about 4 more on caudal. Branchiostegal rays 24–27.

Depth 26.4–28.6, head 28.2–30.0, snout 4.7–7.7, eye 7.2–7.9, post-orbital 12.6–14.0, inter-orbital 5.1–5.7, upper jaw 13.9–15.9, lower jaw 15.2–15.3, gular plate, length 9.6–11.1, width 1.3–1.8, pectoral fin 17.1–20.2, pelvic fin 11.1–15.4, pre-dorsal 52.3–57.0, pre-pelvic 49.3–55.9, pre-anal 72.4–79.0, last dorsal ray 27.0–30.4.

Body elongate, moderately compressed. Mouth very large, terminal. Maxillary reaching beyond posterior border of orbit. Pseudobranch not exposed. Adipose eyelids well developed, almost covering eyes completely. Lateral line well developed, with branched tubes. Pectoral and pelvic axillary scales about two thirds length of fins. Anal fin behind base of dorsal fin, without basal scaly sheath. Last dorsal ray greatly elongated, filamentous, about equal to head or a little more in length.
COLOUR: *Fresh*, dorsal surfaces dark brown, sides silvery to golden; scales with dark borders. Top of head dark brown. A dark patch on posterior edge of operculum. Fins brownish, caudal and dorsal margins dark. Pectoral and pelvic axillary scales speckled light brown.

In alcohol, dorsal surface dark brown to black, sides silvery or light brown. Ventral surfaces white. Dorsal, anal and caudal fins dusky to light brown, darker (almost black) at margins. Pectoral and pelvic fins with brownish speckles.
SIZE: 480 mm. S.L., weight $5\frac{1}{2}$ lb. (♀, Tanga Bay).
DISTRIBUTION: Entire East African coast (recorded from the Mafia Channel, Dar-es-Salaam, Zanzibar, Tanga, Mombasa and Malindi), in estuaries, lagoons, bays and mangrove areas, often together with *Elops*. The species was rarely found out to sea and apparently shows a preference for euryhaline conditions.
RANGE: East African coast south of Natal; Seychelles, Madagascar, Mauritius. Elsewhere, widely distributed in the Indian and Pacific oceans: India, Ceylon, East Indies, Philippines, China, Japan, Formosa, Australia, Melanesia, Micronesia and Polynesia.

Family ALBULIDAE

LADY FISHES

Genus ALBULA Scopoli, 1777

Albula Scopoli, 1777: 450 (on Gronow) (Type: *Esox vulpes* Linnaeus).
A monotypic genus widely distributed in tropical seas.

ALBULA VULPES (Linnaeus)

Esox vulpes Linnaeus, 1758: 313 (on *Bone Fish* Catesby, 1737: pl. 2, fig. 1; Bahamas).
Albula bananus: Valenciennes, 1846 : 345 (Mauritius).
Butirinus glossodontus: Günther, 1866: 120 (Zanzibar).
Butirinus glossodontis: Playfair, 1867: 868 (Seychelles).
Albula conorhynchus: Günther, 1868: 468 (Port Natal, Zanzibar, Red Sea).
Albula conorhyncus: Gilchrist & Thompson, 1908–11: 269 (Natal).
Albula vulpes: Gilchrist, 1913: 53 (Natal); Gilchrist & Thompson, 1917: 293 (references); Barnard 1925: 106 (Natal); Fowler, 1934: 410 (Durban); Smith, 1949–1965: 85, fig. 99 (Natal to Algoa Bay); Baissac, 1951: 124 (Mauritius); Smith, 1955: 306 (Aldabra);Fourmanoir,1957:4,pl.1a(Madagascar); Smith 1958: 131 (Inhaca, Mozambique); *Idem*, 1963: 8 pl. 4A (Seychelles); Whitehead, 1965b: 232 (Red Sea, Gulf of Aden); Losse, 1966b: 168 (East Africa; Zanzibar, Mombasa).
STANDARD COMMON NAME: Bone fish.
VERNACULAR NAMES: *Mnyimbi* (Zanzibar, Shimoni), *Mborode* (Malindi).
DESCRIPTION: Based on a single specimen, 319 mm. standard length, from Zanzibar.

Dorsal iv 13, pectoral i 16, pelvic i 8, anal iii 7. Gillrakers poorly developed, reduced to low tubercles, 12 on lower part of 1st gill arch. Lateral line well developed; scales large, silvery and ad-

herent, from shoulder with three anterior striae, 69 scales in lateral series, 23 pre-dorsal scales, $9\frac{1}{2}$ above lateral line, $7\frac{1}{2}$ below. Branchiostegal rays 12.

Depth 24.5, head 28.0, snout 12.2, eye 4.5, post-orbital 11.5, inter-orbital 7.1, upper jaw 8.4, lower jaw 8.6, projection of snout beyond lower jaw 2.7, pectoral fin 15.6, pelvic fin 11.8, pre-dorsal 50.5, pre-pelvic 59.0, pre-anal 88.1, caudal peduncle 8.0, caudal length 32.4.

Body oblong, moderately compressed, abdomen flattened. Snout pointed, projecting beyond tip of lower jaw. Mouth small, inferior. Maxilla short not reaching eye, just surpassing nares in vertical plane. Gular plate not evident externally. Pseudobranch exposed. Eyes almost completely covered by a thick adipose membrane, only a small oval aperture. Dorsal base nearer to caudal than to the snout; pelvic origin beneath 15th dorsal ray. Dorsal, anal and caudal fins with scaly sheaths at bases. Pelvic axillary scale about half length of fin. Pectoral axillary scale poorly developed. Teeth villiform, on pre-maxilla, lower jaw, vomer and palatines. Maxilla edentulous, upper jaw bordered by pre-maxillae only. Broad patches of granulars teeth on parasphenoid, pterygoid and tongue.

COLOUR: *Fresh*, body silvery with about nine dark zigzag lines along dorso-lateral surface. Top of head greenish. A black spot on each side of snout tip. Scattered melanophores on pectoral, pelvic and anal fins. Anterior dorsal rays with black anterior borders; dorsal margins dark. Caudal tips dusky.

SIZE: 318 mm. S.L. (Zanzibar).

DISTRIBUTION: Entire East African coast (recorded from Zanzibar, Dar-es-Salaam, Mombasa and Malindi), in the vicinity of mangrove areas and in shallow bays over a sandy bottom, where it was often abundant.

RANGE: Eastern coast of Africa from the Red Sea to Algoa Bay; Seychelles, Aldabra, Comores, Madagascar, Mauritius and Reunion. Elsewhere, cosmopolitan in tropical seas.

Suborder CLUPEOIDEI

Key to East African Families

1. Abdominal scutes absent:
   - (i) Body highly compressed; jaw teeth large and fang-like; dorsal origin much nearer to caudal base than to the snout . . . Family Chirocentridae
   - (ii) Body rounder, jaw teeth small, not fang-like; dorsal origin about midway between the snout and the caudal base . . . . Family Dussumieriidae
2. Abdominal scutes present, keeled or spine-like:
   - (i) Mouth terminal or subterminal, snout not pig-like; upper jaw (maxilla) not extending beyond the posterior border of the eye . . . Family Clupeidae
   - (ii) Mouth inferior, snout pig-like; upper jaw (maxilla) extending beyond the posterior border of the eye . . . . . . Family Engraulidae

Family CHIROCENTRIDAE

WOLF-HERRINGS

A single genus widespread in the Indo-Pacific area.

Genus CHIROCENTRUS Cuvier, 1817

Chirocentrus Cuvier, 1817: 178 (Type: *Clupea dorab* Forsk.).
A single species in East African waters.

CHIROCENTRUS DORAB (Forsk.).

Clupea dorab Forsk., 1775: 72 (Type locality: Djedda, Red Sea).

Chirocentrus dorab: Valenciennes, 1846: 150 (Mauritius, Zanzibar, Red Sea); Peters 1855: 268 (Mozambique); Günther, 1866: 120 (Zanzibar); Günther, 1868: 475 (Port Natal, Zanzibar); Peters, 1876: 445 (Mauritius); Gilchrist & Thomspon 1908–11: 202 (Natal); Barnard, 1925: 120 (Delagoa Bay, Natal); Bonde, 1934: 437 (Zanzibar); Fowler, 1934: 410 (Natal); Smith, 1949–1965: 87, pl. 5, fig. 104 (South Africa); Baissac, 1951: 130 (Mauritius); Morrow, 1954: 804 (Pemba); Smith, 1955: 306 (Aldabra); Fowler, 1956: 78 (Indo-Pacific specimens); Fourmanoir, 1957: 7, pl. 1B (Madagascar); Smith, 1958: 131 (Inhaca, Mozambique); *Idem*, 1963: 8 pl. 4 I (Seychelles); Sanches, 1963: 21, fig. 4 (Inhaca, Mozambique); Losse, 1964: 12 (Zanzibar); Whitehead, 1965b: 233 (Red Sea); Losse, 1966a: 89 (Zanzibar); *Idem*, 1966b: 169 (East Africa; Dar-es-Salaam, Zanzibar, Mombasa, Malindi, Lamu); *Idem*, 1966c: 50 (Zanzibar Channel).

STANDARD COMMON NAME: Wolf-herring.

VERNACULAR NAMES: *Mkonge* (Zanzibar, Tanzania), *Panga* (Kenya, general), *Bahanafu* (Malindi).

DESCRIPTION: Based on six fishes, 190–237 mm. standard length, from the Zanzibar Channel; six, 323–341 mm., from Mombasa and one, 319 mm., from Formosa Bay.

Dorsal iii-iv 12–15, pectoral i 12–13, pelvic i 5–6, anal iii–iv 29–31. Gillrakers 3 + 12–16 on 1st gill arch. Scales minute thin and very caducous; scale pockets obliterated, no lateral count possible. Branchiostegal rays 8.

Depth 13.6–16.0, head 17.7–19.2, snout 4.1–7.2, eye 3.0–3.6. post-orbital 7.2–8.5, inter-orbital 2.4–2.7, upper jaw (8.2) 8.6–9.4, lower jaw (9.3) 9.6–10.3, pectoral fin 12.1–13.6, pelvic fin 2.5–3.2, pre-dorsal 67.9–73.6, pre-pelvic (45.6) 48.0–52.4, pre-anal 68.5–72.0, pectoral axillary scale 7.8–8.9.

Body greatly elongated, strongly compressed. Snout pointed, lower jaw strongly inclined. Mouth moderately large and terminal. Maxilla surpassing the angle of the jaws but not reaching to the anterior border of pre-operculum. Pseudobranch not exposed. Adipose tissue well developed, often obscuring eyes. Abdominal scutes absent; a single, small, crescentric pelvic scute. Dorsal origin much nearer to caudal base than to the snout. Anal fin long, the origin just in front or under first ray of dorsal fin. Pelvic fins very small, with a small axillary flap, far in front of dorsal fin, much nearer to pectoral origin than to the caudal base. Dorsal and anal fin with well developed scaly sheaths. Pectoral axillary scale well developed; two long scales on caudal base. Teeth well developed. Two large upper canines pointing forward, covered dorsally by a loose fleshy flap extending from snout. Small pointed teeth on maxilla. Lower jaw with caniniform teeth which increase in size posteriorly. Mandibular rami elevated inside mouth.

COLOUR: *Fresh*, back blue, midline grey; sides and belly silvery. A large green patch on shoulder. Supra-orbital part of head bluish, post-orbital dark. Snouth bluish-grey. Iris dusky to silver. Anterior rays of dorsal fin dusky. Minute dark spots on anterior pectoral rays. Caudal dusky, darker, almost black, at tips; ventral fins and anal fins colourless.

In alcohol, dorsal sufaces bluish-grey, sides yellowish-white. Snout dark. Sub-orbital part of head and operculum silvery; a dark patch on anterior portion of operculum. Dorsal yellowish at base, dusky, margins darker. First pectoral ray with a black anterior edge, rays 1–5 speckled black. Ventral fins and anal fin colourless. In the single specimen from Formosa Bay the caudal fin and outer half of the pectoral fin are entirely black and anal rays 4–7 are speckled black.

SIZE: Specimens (♀♀) of about 800 mm. have been caught in the Zanzibar Channel (by purse-seine); 341 mm. S.L. (♂, Mombasa). Stead (1906) stated "attains a length of fully 12 feet" (Australian seas). Smith (1949) and Fowler stated the same maximum length without reference.

DISTRIBUTION: Entire East African coast (recorded from the Mafia Channel, Dar-es-Salaam, Zanzibar, Shimoni, Mombasa, Malindi, Formosa Bay and Lamu), in the shallow waters within the 30 fathom contour. Abudant over shallow banks (Zanzibar Channel), in bays, harbours (Mombasa), estuaries and also quite common in and around mangrove areas.

RANGE: Eastern coast of Africa from the Red Sea to Natal; Seychelles, Madagascar, Aldabra and Mauritius. Elsewhere, widely distributed in the Indian and Pacific Oceans; India, East Indies, Philippines, China, Formosa, Japan, Queensland and Melanesia.

Family DUSSUMIERIIDAE

ROUNDHERRINGS

Key to the East African Genera

1. Branchiostegal rays 14–16; adults large (> 120 mm. S.L.) (Sub-family Dussumieriinae) . . . . *DUSSUMIERIA*
2. Branchiostegal rays 6–7; adults small (< 80 mm. S.L.) (Sub-family Spratelloidinae)
   (i) A single supra-maxilla; pelvic origin in front of dorsal; last two anal rays separated from others by a gap . . . . . *SPRATELLOMORPHA*
   (ii) Two supra-maxillae; pelvic origin under dorsal base; anal fin entire . . . . *SPRATELLOIDES*

Sub-family DUSSUMIERIINAE

Genus DUSSUMIERIA Valenciennes, *1847*

Dussumieria Valenciennes, 1847: 467 (Type: *Dussumieria acuta* Val.)
A single species in East African waters.

DUSSUMIERRA ACUTA (Valenciennes)

Dussumieria acuta Valenciennes, 1847: 467, pl. 606 (Type locality: Bombay); Whitehead, 1963b: 312, fig. 1–5 (revision, synonymy; Indo-Pacific specimens); Losse, 1964: 12 (Zanzibar Channel); Whitehead 1965b: 234 (Red Sea, Gulf of Aden); Losse, 1966a: 89 (Zanzibar); *Idem*, 1966b: 170 (East Africa; Dar-es-Salaam, Zanzibar, Kenya); *Idem*, 1966c: 51 (Zanzibar Channel).
Dussumieria hasseltii: Fourmanoir, 1961: 84, fig. 1 (Madagascar).
STANDARD COMMON NAME: Round Herring.
VERNACULAR NAMES: *Dagaa la upapa* (Zanzibar), *Dagaa* (general).

DESCRIPTION: Based on twenty-five fishes, 70-144 mm. standard length, from Zanzibar and one, 124 mm., from Mombasa. Depth measurements and meristic characters on nine further fishes, 87.5–154 mm., from the Zanzibar Channel.

Dorsal iv–v 16–17 (19), pectoral i 12–13, pelvic i 7, anal iii (12) 13–14. Abdominal scutes absent, a single "W" shaped pelvic scute (Whitehead, 1962). Gillrakers, 25–28 on lower part of 1st gill arch. Branchiostegal rays 14–16. Scales caducous, scale pockets virtually all obliterated, no count possible. Vetebrae 54–56 (8 fishes).

Depth 18.5–25.1 (increasing with length of fish), head 26.0–28.4, snout 8.7–9.7, eye 5.9–7.0, post-orbital 8.4–10.4, upper jaw 7.9–8.7, lower jaw 12.6–13.8, pectoral fin 11.9–14.8, pelvic fin 8.1–10.8, pre-dorsal 54.3–58.6, pre-pelvic 58.0–61.9 (62.2), pre-anal (77.4–78.5) 79.0–81.5, anal base 9.2–11.3.

Body oblong, moderately compressed, rounded ventrally. Snout pointed, longer than the eye diameter. Lower jaw projecting slightly in front of upper. Maxilla short, not quite reaching anterior border of orbit. Two supra-maxillae, the second (posterior) not expanded posteriorly. Conical teeth on pre-maxilla, maxilla and mandible. Pelvic origin under dorsal base, nearer to pectoral origin than the caudal base. Dorsal origin nearer to caudal base than to the snout.

COLOUR: *Fresh*, dorsal surface blue-grey. A dark blue mid-dorsal line often with a greenish tinge. Iridescent golden lateral stripe from the operculum to the caudal base. Flanks silver with a golden hue in some fishes. Top of head greenish to golden. Tip of upper jaw black. Tip of mandible dusky. Operculum mainly silvery with a few melanophores on dorsal border; on pre-operculum dark spots form faint lines. A few dark spots on anterior rays of dorsal fin. First ray of pectoral fin dark and a few dark spots on central rays of fin. Caudal dusky, darker at margins, colourless in some (small) specimens. Pelvic fins and anal fin colourless.

In alcohol, dorsal surfaces brownish, flanks light brown to grey. A light lateral band visible in some specimens. Snout dark. First ray of pectoral fin and anterior rays of dorsal fin dark. Caudal darkish at tips in some specimens, otherwise yellowish or colourless.

SIZE: 154 mm. S.L. (♀, Zanzibar Channel), maximum 216 mm. in India (Day).

DISTRIBUTION: Entire East African coast (recorded from Dar-es-Salaam, Zanzibar and Mombasa) in the shallow waters within the 100 fathom contour. A single specimen was taken from the stomach of a sailfish caught in 250 fathoms on longline off Mombasa. Not evident in bays, harbours or estuaries; the species was abundant over shallow water banks (Zanzibar Channel) in depths of 8–18 fathoms principally during the northeast monsoon (October—February).

RANGE: Eastern coast of Africa from the Red Sea to Madagascar. Elsewhere, widely distributed in the Indian and Pacific Oceans, east to Japan. Also as an immigrant species in the Suez Canal and the eastern Mediterranean, from Port Said to Mersin in Turkey (Ben-Tuvia, 1966).

Sub-family SPRATELLOIDINAE

Genus SPRATELLOMORPHA Bertin 1946

Spratellomorpha Bertin, *in* Angel, Bertin & Guibé, 1946: 473–4 (Type: *Sauvagella madagascariensis bianalis* Bertin, *ex* Madagascar.

A monotypic genus; known from four fishes (types) from Madagascar and ten juvenile specimens recently discovered by the author at the Mombasa fish market. The species has not been recorded previously from East Africa.

SPRATELLOMORPHA BIANALIS (Bertin)

Plate 1b

Sauvegella madagascariensis binalis Bertin, 1940: 300 (*ex*-Madagascar).
Sauvagella bianalis Bertin, 1943: 22, fig. 8; Whitehead, 1936b: 336, fig. 14 (revision; Madagascar).
Spratellomorpha bianalis Bertin, 1946: 473–4.
STANDARD COMMON NAME: Estuarine sprat.
VERNACULAR NAMES: *Dagaa* (Mombasa).
DESCRIPTION: Based on seven fishes, 30.2–41.3 mm. standard length from Port Tudor, Mombasa.

Dorsal iii 11–12, pectoral i 11–12, pelvic i 7, anal iii (12) 13+2, total (17) 18. Gillrakers 26–28 (three fishes) on lower part of 1st gill arch. Branchiostegal rays 6. Scales caducous, about 41 (pockets) in lateral series.

Depth 17.7–21.8, head 26.3–27.7, snout 6.1–6.7, eye 6.7–7.6, post-orbital 7.3–9.0 (11.3), maxilla 9.2–10.0, lower jaw 11.0–12.2, pectoral fin 15.8–19.2, pelvic fin 11.6–12.7 (13.2), pre-dorsal 54.7–58.1, pre-pelvic 49.4–54.7, pre-anal 69.6–75.6.

Body elongate, laterally compressed, its depth less than the length of the head. Snout pointed, less than eye diameter in length. Abdominal scutes entirely absent, a single pelvic scute with pointed ascending spines. A single supra-maxilla, expanded posteriorly, almost equal to maxilla in depth, with a narrow anterior shaft. A single row of conical teeth on pre-maxilla and maxilla. Maxilla longer than snout, reaching vertical through anterior border of the eye. Dorsal origin much nearer to caudal base than to snout, about equidistant from anterior border of eye and caudal base. Pelvic

origin in front of dorsal, nearer to the anal base than to pectoral origin. Anal origin much nearer to pelvic origin than to the caudal base. Last two rays of anal fin separated from others by a space which equals two or three rays bases.

COLOUR: *Fresh*, mainly translucent; dorsal and lateral surfaces very light brown, peritoneum white. A faint, poorly defined, silvery to golden lateral band from operculum to caudal base, widest behind dorsal base, narrower than pupil of eye. A few brown spots on head between orbits, post-orbital surface of head brown. Two parallel rows of minute black spots on median dorsal surface from the nape to the dorsal origin and continued from the last dorsal ray to the caudal base. Snout and tip of lower jaw faintly yellowish with a few small dark spots. Lower jaw, sides of head and operculum silvery. Bases of dorsal and caudal fin yellowish, caudal rays with minute orange spots and a few scattered melanophores; two black lines on caudal base and a black streak on the upper border of the caudal peduncle. A row of black spots along base of anal and first two rays of pectoral fin with a few melanophores, rest of fins colourless.

In alcohol, light brown with a very faint, poorly defined silvery lateral band from operculum to caudal base, hardly evident in some specimens. Dark markings all retained, rest faded.

SIZE: 41.3 mm. S.L. (Mombasa), 45.5 mm. in Madagascar (Bertin).

DISTRIBUTION: Port Tudor, Mombasa district. The species is probably more widespread than the present record would indicate. The isolated recorded occurrences of specimens at Port Tudor (Mombasa), essentially an area where estuarine conditions prevail, would indicate that the species may be confined to estuaries in East African waters.

RANGE: East Africa (Mombasa). Elsewhere, Madagascar.

REMARKS: The first specimen of *Spratellomorpha bianalis* from the Kenya Coast was discovered by the author at the Mombasa fish market in April 1965. Nine further fishes were obtained from the same locality in December. All were caught in stake traps (*uzio*) at the entrance to Port Tudor, Mombasa, together with wolf-herrings (*Chirocentrus*), herrings (*Herklotsichthys*), sardines (*Sardinella*) and anchovies (*Thrissina* and *Thryssa*). In addition to these ten specimens from Mombasa the only other examples in existence appear to be the four types, 44.0–45.5 mm. S.L., in the Paris Museum (No. A5174), which Bertin described from Madagascar.

TABLE 1

A comparison of proportional measurements and meristic characters of East African and Malagasy *Spratellomorpha bianalis*

	East African material (7 fishes)	*Malagasy material* (After Whitehead, 1963) (4 fishes)
Standard length	30.2–41.4 mm.	44.0–45.5 mm.
In % of S.L.	*mean*	*range*
Body depth	20.40	17.1–18.0
Head length	27.11	25.2–26.5
Snout length	6.40	6.9– 7.1
Eye diameter	7.02	7.2– 7.8
Post-orbital distance	8.80	8.4– 8.6
Maxilla length	9.65	9.7–10.0
Lower jaw length	11.67	–
Pectoral fin length	17.40	–
Pelvic fin length	12.28	–
Pre-dorsal distance	56.71	53.4–56.5 (62.8)
Pre-pelvic distance	52.48	49.4–52.2
Pre-anal distance	73.15	69.0–72.5
Dorsal rays: simple	iii	iii
branched	11–12	12–13
Anal rays: simple	iii	iii
branched	12–13+2	11–12+2
Pectoral rays (total)	12–13	13

Both in meristic characters and body proportions East African *S. bianalis* agree closely with Malagasy material (Table I). The slight differences which are evident may indicate that East African and Malagasy specimens represent distinct populations; assuming that the species is truly estuarine, isolation is probably complete.

Spratellomorpha and other dussumieriid genera placed in the tribe Ehiravini (vide Whitehead, 1963) are of considerable interest as they show close affinities with the true herrings (Clupeidae) in a number of features (Whitehead, *loc. cit.*). Recently it has been suggested that they may be better placed in the sub-family Pellonulinae of the Clupeidae (Poll *et al.*, 1965).

Genus SPRATELLOIDES Bleeker, 1852

Spratelloides Bleeker, 1852: 29 (Type: *Clupea argyrotaeniata*=*Clupea gracilis* Schlegel).
Stolephorus (non Lacépède) Fowler, 1941 : 561.
Two Indo-Pacific species, both of which occur in East African waters.

Key to the East African Species

1. Total anal rays 11–14; a prominent silver lateral band from operculum to the caudal base . . . . *S. gracilis*
2. Total anal rays 9–11; no silver lateral band, whole of flanks silvery . *S. delicatulus*

SPRATELLOIDES GRACILIS (Schlegel)

Clupea gracilis Schlegel, 1846: 238, pl. 108, fig. 2 (Type locality: Japan).
Spratelloides japonicus: Morrow, 1954: 804 (Mkoani harbour, Pemba).
Spratelloides gracilis: Whitehead, 1963b: 388, fig. 15–18 (revision, synonymy; Red Sea and Pacific specimens, Whitehead, 1965b: 273, figs. 2b, 3b, (Red Sea); Losse, 1966b: 170 (East Africa; Mafia, Zanzibar).
STANDARD COMMON NAME: Silver-striped sprat.
VERNACULAR NAME: *Dagaa* (general).
DESCRIPTION: Based on three fishes, 28.0–56.0 mm. standard length, from the Mafia Channel; seven 40.5–52.0 mm., from Zanzibar and six, 22.1–51.0 mm., from Shimoni.

Dorsal iii 9–10, pectoral i 11–12 (14), pelvic i 7, anal ii 9–12, total 11–14. Scales caducous, no accurate count possible (about 40–50 in Red Sea specimens; Whitehead 1964b). Branchiostegal rays 6.

Depth 12.6–17.4, head 23.8–25.8 (28.0), snout 7.2–9.5, eye 4.8–6.9, post-orbital 8.2–10.9, upper jaw 8.6–9.9, lower jaw 9.8–12.5, pectoral fin 11.4–14.2, pelvic fin 9.7–12.1, pre-dorsal 46.4–50.5, pre-pelvic 53.4–58.8, pre-anal 80.0–84.1.

Body moderately compressed. Snout pointed, slightly longer than the eye diameter. Head longer than the maximum body depth. Maxilla moderately long, the posterior border beneath the anterior third of the orbit, not reaching anterior border of the pupil. Dorsal origin a little nearer to snout than to the caudal base, or about equidistant. Pelvic origin under posterior half of dorsal, slightly nearer to the caudal base than to the snout.
COLOUR: *Fresh*, dorsally pale green with a dark-dorsal line. A prominent silver lateral band from operculum to the caudal base, as wide as eye diameter, edged above and below by a fine blue line. Pupil black, iris silver. A small black mark just behind eye. Head silver with small black markings on lower jaw and snout. Bases of caudal rays and posterior border of caudal peduncle with fine black markings. Fins otherwise colourless.

In alcohol, upper and lower surfaces brownish, a silver lateral stripe prominent in some specimens, but faded in others to a dark band: poorly defined in juvenile specimens. All black markings retained.
SIZE: 56 mm. S.L. (Mafia Channel), 93 mm. S.L. in Japan (Whitehead, 1963b).
DISTRIBUTION: East African coast (recorded from Kilwa, Mafia Channel, Zanzibar Channel, Pemba and Shimoni) in the shallow waters, especially in and around coral reef areas. Not observed in estuaries, harbours, creeks or muddy bays. At times abundant, but great fluctuations in abundance were evident from year to year.
RANGE: Eastern coast of Africa from the Red Sea to Kilwa in Tanzania. Elsewhere, widely distributed in the Indo-Pacific, east to Ceylon, Laccadive islands, Japan and Samoa.

SPRATELLOIDES DELICATULUS (Bennett)

Clupea delicatula Bennett, 1831 : 168 (Type locality: Mauritius).
Spratelloides delicatulus: Peters 1876: 445 (Mauritius); Jatjow & Lenz, 1899: 526 (no locality—East African collection); Regan, 1908: 242 (Kosi Bay); Gilchrist & Thompson, 1917: 296 (South Africa); Barnard, 1925: 110 (Zululand); Morrow, 1954: 809 (Mkoani harbour, Pemba); Fourmanoir, 1957: 13 (Madagascar, Comores); Whitehead, 1963b: 345, figs. 16–17, 19, 25, 28a, 30c, 31 (references, synonymy, revisions; Zululand, Seychelles, Red Sea, Gulf of Aden); *Idem*, 1965b: 241, figs. 2a, 3a (Red Sea, Gulf of Aden); Losse, 1966b: 171 (East Africa; Mafia, Zanzibar, Kilifi); *Idem*, 1966c: 51 (Zanzibar Channel).
Stolephorus delicatulus: Smith 1949–1965: 89, fig. 107 (South Africa); Baissac, 1951: 126 (Mauritius);

Smith, 1955: 307 (Aldabra), *Idem*, 1958: 131 (Inhaca, Mozambique); *Idem*, 1963: 8, pl. 4B (Seychelles).
STANDARD COMMON NAME: Common sprat.
VERNACULAR NAME: *Dagaa* (general).
DESCRIPTION: Based on eight fishes, 43.9–51.1 mm. S.L., from Kilifi and five 23.3–48.0 mm., from Shimoni.

Dorsal ii 9–10 (11), pectoral i 10-12, pelvic i 7, anal ii–iii 7–9, total 10–11. Scales moderately caducous, about 32–35 (pockets) in lateral series. Branchiostegal rays 6.

Depth 13.8–20.8, head 25.3–28.8, snout 6.3–8.0, eye 5.5–7.5, post-orbital 9.0–10.4, upper jaw 8.1–10.5, lower jaw 9.8–12.2, pectoral fin 12.5–17.6, pelvic fin 11.0–14.4, pre-dorsal 45.9–48.7, pre-pelvic 53.8–57.0, pre-anal (78.5) 81.4–84.1.

Body moderately compressed. Snout pointed, slightly longer than eye diameter. Maxilla longer than snout, almost reaching pupil. Dorsal origin slightly nearer to snout than to the caudal base. Pelvic origin under posterior half of dorsal fin, slightly nearer to caudal base than to the snout.

COLOUR: *Fresh*, dorsal surface bright blue with darker blue mottlings, sides silvery, belly white. Pupil black, iris silver. Small black marks on upper part of operculum. Tip of snout and lower jaw speckled black. A prominent black mark a little in front and below eye. Two black lines on caudal base and one along the upper border of the caudal peduncle. Fins colourless.

In alcohol, upper surfaces bluish, grey or brown, sides white or silvery, belly white. Top of head, snout tip and lower jaw dark brown to black. A small black spot in front of eye. Fins colourless.
SIZE: 51 mm. S.L. (Kilifi, Kenya), 77 mm. S.L. in Australian seas (Whitehead, 1963b).
DISTRIBUTION: Probably entire East African coast (recorded from Kilifi, Shimoni, Pemba, Zanzibar Channel and Mafia Channel), in the shallower inshore waters; in and around coral reef areas, in bays, inlets, lagoons and estuaries. Often together with *S. gracilis* but more abundant and widespread.
RANGE: Eastern coast of Africa from the Red Sea to Zululand; Seychelles, Aldabras, Comores, Madagascar and Mauritius. Elsewhere, the species ranges widely in the Indo-Pacific, eastwards to Australia.

Family CLUPEIDAE

HERRINGS

Key to the East African Genera

1. Anal fin short, with less than 30 rays; hypomaxillary bone absent:
   - (i) Upper jaw without deep median notch; tip of lower jaw does not fold completely within the upper (Sub-family Clupeinae):
     - (a) Few (3–5) fronto-parietal striae; scale striae complete; last two anal rays not enlarged . . . . *HERKLOTSICHTHYS*
     - (b) Many (7–15) fronto-parietal striae; scale striae interrupted; last two anal rays markedly enlarged . . . . . *SARDINELLA*
   - (ii) Upper jaw with a prominent deep median notch; tip of lower jaw folds completely within the upper (Sub-family Alosinae) . . *HILSA*
2. Anal fin long, with more than 30 rays; a small toothed hypomaxillary bone present (Sub-family Pristigasterinae) . . . . . . *PELLONA*

The genera *Herklotsichthys* and *Sardinella* are frequently confused; detailed diagnostic features of these two genera have been published by Whitehead (1964c).

Hilsa also has been confused in collections with *Sardinella*, generally with a deep-bodied form such as *S. albella*. The single species in East African waters, *H. kelee*, may be distinguished at once by the combination of depth (33–40% in S.L.) and gillraker number (74–177), as all known species of *Sardinella* from East African waters with a deep body (over 30% in S.L.) have fewer gillrakers (less than 60). Further, in *H. kelee* the gillrakers are very long and easily visible when the mouth is opened and the scales are firmly adherent; in *Sardinella* the gillrakers are shorter and the scales are caducous.

Sub-family CLUPEINAE

Genus HERKLOTSICHTHYS Whitley, 1951

Herklotsichthys Whitley, 1951: 67 (proposed to replace *Herklotsella* Fowler, 1934: 246).
Harengula Valenciennes (part., i.e. Indo-Pacific species only), 1847: 201 (Type: *Harengula latulus* Valenciennes = *Clupea macrophthalma* Ranzani).

New world *Harengula* species are characterised by the presence of a toothed hypomaxilla which is absent in Indo-Pacific fishes formerly placed in this genus (Berry, 1964); *Herklotsichthys* replaces *Harengula* for Indo-Pacific species (Whitehead, 1964a).

Previously two species of the genus, *H. punctatus* and *H. vittatus*, were recognised from the extreme western Indian Ocean and adjacent seas (e.g. Smith, 1949; Whitehead, 1965b). The so-called *Sardinella*-like *H. vittatus* (Whitehead, 1964c) however, should now be placed in the synonymy of *Sardinella melanura* (Cuvier) (Whitehead, 1967).

HERKLOTSICHTHYS PUNCTATUS (Rüppell)

Clupea punctata Rüppell, 1837: 78, pl. 21, fig. 2 (Type locality: Red Sea).
Alosa punctata: Günther, 1866: 123 (Aden, Zanzibar).
Clupea venenosa: Günther, 1868: 449 (Zanzibar).
Harengula punctata: Sauvage, 1891: 493 (Madagascar); Regan, 1917 (East Africa); Barnard, 1925:114 (Natal); Losse, 1964: 11 (Zanzibar Channel).
Sardinella melanura: Smith, 1949–1965: 92, fig. 113 (Natal); *Idem*, 1963: 8, pl. 4 L (Seychelles).
Harengula ovalis: Smith, 1949–1965: 91 (Natal); Baissac, 1951: 126 (Mauritius); Smith, 1955: 307 (Aldabra); Fowler, 1956: 64 (Indo-Pacific specimens); Smith, 1963: 8, pl. 4 G (Seychelles); Sanches, 1963: 20, fig. 3 (Inhaca, Mozambique).
Herklotsichthys punctatus: Whitehead, 1965b: 244 (Red Sea, Gulf of Aden); Losse, 1966a: 89 (Zanzibar); *Idem*, 1966b: 172 (East Africa; Dar es-Salaam, Zanzibar, Tanga, Mombasa, Malindi, Formosa Bay); *Idem*, 1966c: 51 (Zanzibar Channel).

Two distinct forms, which may prove to be distinct species (see REMARKS), are here described.

Key to the East African Forms

1. Body deep, depth 29–33% (mean 31.4%) in S.L. (at 48–85 mm.); a prominent black patch on dorsal fin	*H. punctatus* Form *A*
2. Body slender, depth 24–29% (mean 26.7%) in S.L. (at 32–120 mm.); dorsal fin dusky, without black patch)	*H. punctatus* Form *B*

HERKLOTSICHTHYS PUNCTATUS Form *A*

STANDARD COMMON NAME: Spotted herring.
VERNACULAR NAME: *Dagaa* (Zanzibar, Tanzanian coast).
DESCRIPTION: Based on forty-seven fishes, 47.6–84.8 mm. standard length, from the Zanzibar Channel. Vertebral counts only on six fishes, 76.7–83.6 mm., from Shimoni, Kenya.

Dorsal iii–iv (13) 14–15, pectoral i 14–15 (16), pelvic i 7, anal ii–iii (12–13) 14–15 (16), total (14–15) 16-17 (18). Ventral scutes strongly keeled, sharp and exposed, (15) 16–17 pre-pelvic, (10–11) 12–13 post-pelvic, total (27–28) 29–30. Gillrakers, 30–34 (mean 32.39) on lower part of 1st gill arch (at 47.6–84.8 mm. S.L.). Branchiostegal rays 5–6. Scales caducous, about 34–38 (pockets) in lateral series. Vertebrae 41–42 (6 fishes).

Depth 29.0–33.3 (mean 31.39), head 27.8–31.6, snout 6.7–8.3, eye 8.0–10.3, post-orbital 8.9–11.7, upper jaw 12.4–14.0, lower jaw 12.3–13.8 (14.4), pectoral fin (19.0–19.8) 20.1–21.9 (23.0), pelvic fin (11.1–13.9) 14.0–15.8, pre-dorsal 44.8–48.5, pre-pelvic 50.6–55.6, pre-anal 74.5–83.6, caudal peduncle 9.9–11.9. (The means of these values are shown in Table 2.)

Body very strongly compressed; ventral profile deeply convex, dorsal profile almost a straight line. Head as long as the maximum body depth or up to 2% shorter. Snout generally shorter than the eye diameter. Upper jaw much longer than the snout, the maxillary reaching about $\frac{1}{3}$ to $\frac{1}{2}$ into the eye through the vertical. Operculum about twice as long as broad, the lower margin straight. Sub-operculum rectangular, the posterior margin rounded. Dorsal fin base much nearer to snout than to the caudal base. Pelvic origin almost equidistant from the pectoral base and the anal origin. Scales (from shoulder) with 5–6 complete vertical striae; the posterior scale borders very slightly crenulated or indented, without perforations. Very rarely one or two striae are not complete (as in *Sardinella*) but interdigitate; at least four striae are always uninterrrupted.

COLOUR: *Fresh*, scales fallen; dorsal surfaces bluish green, back spotted with numerous small, blue, grey or black blotches which become less distinct at later post-mortem and may fade entirely. A bright yellow or orange humeral patch continued in a lateral stripe to the caudal base, demarcating dorsal and lateral colouration. Sides, belly and opercular regions silvery or golden. Snout and lower jaw yellowish, tips dusky, occasionally minutely speckled green. Eye silvery with a broad, dorsal yellow or orange band. Dorsal fin orange at base, the anterior rays bright yellow. A prominent black patch on about the first ten dorsal rays. Caudal yellowish at base, dusky or colourless at margins. Other fins colourless.

Underwater the yellow or orange markings and the black patch on the dorsal fin were particularly striking and at once distinguished this species from other clupeoids of the area.

In alcohol, dorsal surfaces greenish or brown, sides lighter. Black patch on dorsal fin retained and prominent (at all stages of fixation). Caudal yellowish or colourless, margin dusky in some fishes. Snout tip dusky or brown. Rest faded.

SIZE: 88.0 mm. S.L. (Zanzibar Channel): 102 mm. F.L., weight 16 gm. (♂, Shimoni, Kenya).
DISTRIBUTION: East African coast (recorded only from Shimoni, Tanga and the Zanzibar Channel), in the vicinity of coral reef areas where it was occasionally abundant; rare elsewhere. Often observed underwater in shoals of about 40-200 fish, frequently swimming together with small shoals of juvenile *Sardinella sirm.*
RANGE: Eastern coast of Africa, apparently from the Red Sea to Natal depending on the exact identity of this form.

REMARKS: I have designated this species *H. punctatus* form *A*. Whitehead's (1965b) description of *H. punctatus* from the Red Sea/Gulf of Aden area overlaps the present descriptions of East African *Herklotsichthys* material of this and the following form. Rüppell's (1837) *Clupea punctata* types (57.7–60.6 mm. S.L., Senckenberg Museum No. 567, 6649 and 6650, *ex*-Red Sea) are characterised by relatively slim bodies (body depth 27.53%, *c.f.* a mean of 31.39% in S.L. in East African *H. punctatus* form *A*) and a high gillraker count (35–36, *c.f.* 30–34 in East African material) and therefore are closer to *H. punctatus* form *B* (Table 2). But Rüppell's colour notes on *Clupea punctata* are very similar to *H. punctatus* form *A*. On present evidence Red Sea/Gulf of Aden material does not demonstrate the existence of two forms, whereas East African specimens of *Herklotsichthys* show divergences which clearly demonstrate that two distinct forms exist in this area. The status of form *B* is discussed below.

TABLE 2

Proportional measurements and meristic characters of *Herklotsichthys punctatus* Form *A*, *Clupea punctata* Rüppell and *Herklotsichthys punctatus* Form *B*.

	H. punctatus A. (45 fishes)	*Clupea punctata* (3 fishes, types *)	*H. punctatus B.* (44 fishes)
Standard length	47.5–84.8 mm.	57.7–60.6 mm.	54.2–120.0 mm.
In % of S.L.	*mean*	*mean*	*mean*
Body depth	31.39	27.53	26.71
Head length	29.54	29.56	28.49
Snout length	8.48	7.96	7.28
Eye diameter	9.94	10.16	7.97
Post-orbital distance	10.19	9.63	9.45
Upper jaw length	10.13	14.20	12.45
Lower jaw length	13.27	—	11.99
Pectoral fin length	20.76	19.36	19.72
Pelvic fin length	14.59	12.63	13.30
Pre-dorsal distance	46.67	45.60	46.79
Pre-pelvic distance	53.50	56.30	53.02
Pre-anal distance	78.60	78.63	78.09
Caudal peduncle, depth	11.00	—	8.95
Dorsal rays: simple	iii–iv	iv	(iii) iv
branched	(13)14–15	14	14–15
Anal rays: simple	ii-iii	iii	ii–iii
branched	(12–13)14–15(16)	12–13	14–16(17)
Abdominal scutes	(15)16–17+(10–11)12–13	17–18+11–12	17–18(19)+(12)13–15
Gillrakers	30–34 (mean 32.39)	35–36	31–37 (mean 34.29)
Vertebrae	41–42 (6 fishes)	—	43–44 (6 fishes)

**Senckenberg Museum* No. 567 (lectotype), No. 6649 and No. 6650, *ex* Red Sea.

HERKLOTSICHTHYS PUNCTATUS Form B

Plate 1c

STANDARD COMMON NAME: Common herring.
VERNACULAR NAMES: *Dagaa la upapa* (Tanzania), *Simu* (Kenya coast), *Simu yati* (Mombasa district), *Dagaa* (small specimens, general).
DESCRIPTION: Based on two fishes, 99.6–107.5 mm. standard length, from Malindi, ten, 32.0–82.6 mm., from Mombasa, forty-five, 22.0–110.0 mm., from Zanzibar, and five, 103.5–120.1 mm., from Dar-es-Salaam. Vertebral counts only on six fishes, 87.8–95.2 mm., from Shimoni.

Dorsal iii–iv 14–15 (16), total 18–19 (20); pectoral (13) 14–15; pelvic i 7; anal ii-iii 14–16 (17), total 16–19 (20). Ventral scutes strongly keeled, sharp and exposed, 17–18 (19) pre-pelvic, (12) 13–15 post-pelvic, total (29–30) 31–33. Gillrakers, at 22–32 mm., 23–29; at 36 mm. and above, 31–37 (mean 34.29) on the lower part of 1st gill arch. Branchiostegal rays 6. Scales fairly caducous, about 38–42 (pockets) in lateral series. Vertebrae 43–44 (6 fishes).

Depth, at 22.0–28.6 mm. S.L., 17.0–23.6 (mean 20.23), at 32–120 mm. S.L. 24.2–29.2 (mean 26.71); head (26.0–26.9) 27.4–30.6; snout 6.8.–8.1, eye 6.8–8.8, post-orbital 8.5–10.4, upper jaw 11.1-13.7, lower jaw 10.4–12.9, pectoral fin 17.0–21.7, pelvic fin 12.0–14.8, pre-dorsal (41.6) 45.1 –49.2, pre-pelvic (46.6) 50.0–56.8, pre-anal 70.1–81.0, caudal peduncle 7.9–10.3. (The means of these values are shown in Table 2.)

Body strongly compressed. Ventral profile rather more convex than the dorsal. Head about 1–3% longer than the maximum body depth. Snout generally shorter than the eye diameter. Upper jaw longer than the snout, the maxilla reaching about $\frac{1}{3}$ to almost $\frac{1}{2}$ into the eye through the vertical. Operculum $2\frac{1}{2}$–$3\frac{1}{2}$ times as long as broad, the lower margin slightly oblique. Sub-operculum rectangular, the posterior margin straight. Dorsal fin base slightly nearer to snout than to the caudal base; pelvic origin nearer to anal origin than to pectoral origin, or about equidistant. Scales (from shoulder) with 5–6 complete vertical striae; posterior borders slightly crenulate, no perforations. COLOUR: *Fresh*, at about 30–40 mm., dorsal surfaces greenish brown. A narrow blue-black lateral band demarcates dorsal and lateral colours with above it a broad silver band from operculum to caudal base. Peritoneum white. Anterior dorsal rays dusky. Upper jaw black. Top of head greenish. Caudal dusky at tips.

At about 60 mm. and above, dorsal surfaces greenish-blue. Humeral spot yellowish with minute melanophores. Narrow electric blue or greenish dorsal-lateral band from operculum to caudal base, bordered ventrally by a thin black line which demarcates dorsal and lateral colourations. Sides and belly silvery. Two oblique dark bands in post-orbital position. Snout black, without yellow markings. Lower jaw tinged faintly yellow, tip dark or brown or black. Dorsal fin greyish with a yellow tinge, tips darker. Caudal fin dusky, often with black margins. Other fins colourless. The prominent black patch on the dorsal fin and the yellow-orange lateral band of the previous form are absent.

In alcohol, at 24.3 mm., mid-dorsal surface light brown, rest of body yellowish white (scales absent), with an indistinct narrow black line from operculum to caudal base (silvery in life). Snout tip dusky. Sides of head with minute black spots often forming a horizontal row below eye. Posterior dorsal scale pockets brownish. Dorsal fin with a few black spots on anterior rays, caudal similarly coloured; a row of black spots along anal base. Other fins colourless.

At 33–40 mm., dorsal surfaces greenish brown, sides lighter. A narrow dark lateral band (silvery in life) from operculum to caudal base, about eye diameter or a little more in width. Snout tip dusky. Sides of head and lower jaw with brown speckles. Anterior dorsal rays and caudal light brown. Row of black/brown spots along anal base just distinct.

At 50 mm. and above, dorsal surfaces greenish brown or bluish (scales lost), sides yellowish white (due to formalin). A prominent narrow blue-black line from operculum to caudal base is evident in most large specimens. Tip of snout and lower jaw dark brown or black. Dorsal and caudal fins dusky. First rays of pectoral fin often speckled black, other fins hyaline. No prominent black patch on dorsal fin (as in the previous forms); tips of caudal fin evenly dusky.

SIZE: 120 mm., S.L. (Dar-es-Salaam); 137 mm., F.L., weight 42 gm. (♀, Dar-es-Salaam).

DISTRIBUTION: Entire East African coast (recorded from Lamu, Formosa Bay, Malindi, Mombasa, Shimoni, Tanga, Zanzibar Channel and Mafia Channel), mainly in bays, harbours (Mombasa, Dar-es-Salaam) and the shallow waters very close to the shore. A neretic species which rarely extends seawards. Generally most abundant over a muddy substrate, rarely caught in or around coral reef areas. Present throughout the year, but seasonally extremely abundant during the northeast monsoon, also during and shortly following the rainy seasons.

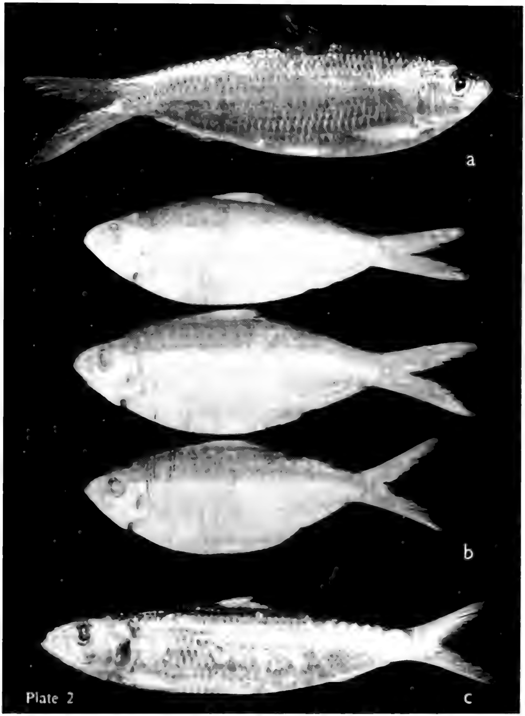
RANGE: Eastern coast of Africa from the Red Sea to Natal; Seychelles, Madagascar. Probably widely distributed in the Indian Ocean.

REMARKS. Previously this form has been confused with *H. punctatus* form *A*, but on the basis of East African material it is quite distinct. I cannot at present relate it to any previous description as the literature is too confused. In the field it can be distinguished from *H. punctatus* form *A* by the more slender body (mean body depth 26.71% in S.L., *c.f.* 31.39% in *H. punctatus* form *A*), and colouration (dorsal fin evenly dusky, black patch on dorsal fin and yellow lateral band absent, *c.f.* prominent black patch on dorsal fin and yellow lateral band present in *H. punctatus* form *A*). Further characters which distinguish form *B* from form *A* are the number of gillrakers (Table 3), lateral scales (about 39–42, *c.f.* 34-38), abdominal scutes (total generally 31–33, *c.f.* 29–30) and vertebrae (43–44, *c.f.* 41–42). Meristic characters and mean values for proportional measurements are compared in Table 2. Differences in the biology of these closely allied herrings were evident.

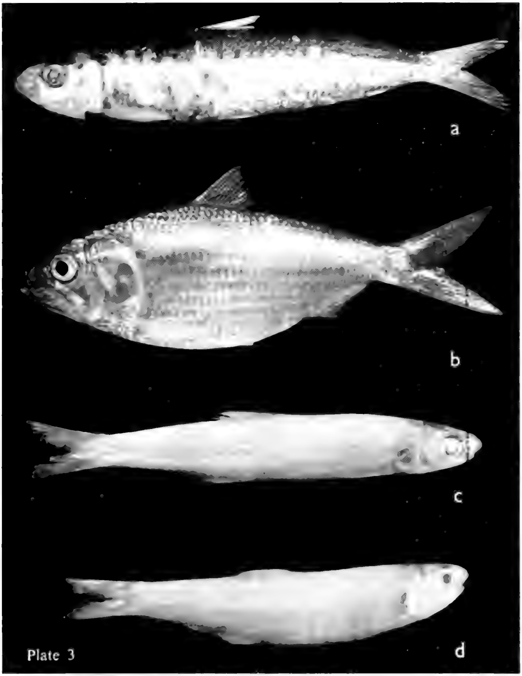
Günther's (1868) specimens of *Clupea venenosa* from Zanzibar are *H. punctatus* form *B*, as also five specimens labelled *Sardinella melanura* from the collection of the Ichthyology Department, Grahamstown (S.A.), sent to me by Professor J. L. B. Smith (No. 816, Delagoa Bay, 108 mm. S.L.; No. 7179, Isipingo, 92.5 mm. S.L.; no number, Mahé, Seychelles, collected on 13.9.54, 96 mm. S.L.; No. 270, Zanzibar, 71 mm. S.L.; No. 607, Pinda, 57.5 mm. S.L.). These specimens fall within the descriptions of East African material. Therefore it also appears very likely that at least some previous records of *Sardinella melanura* (Cuvier) from the Western Indian Ocean were based on *Herklotsichthys*.

The two forms of *H. punctatus* described would certainly appear to be two distinct species. What has prevented me from describing them as such is that neither can be completely identified with

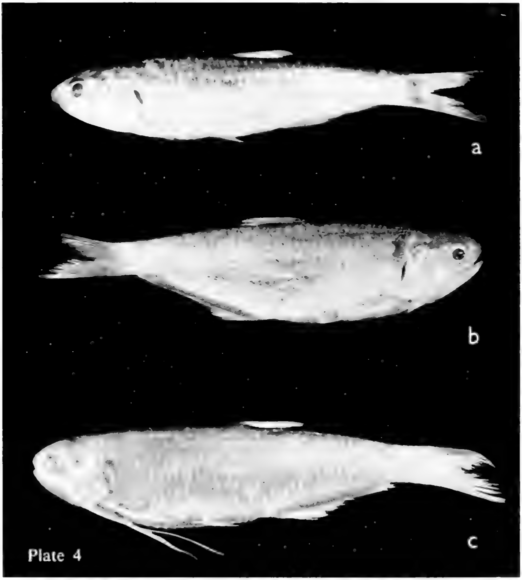
a *Elops machnata* (Forsskal)
b *Spratellomorpha bianalis* (Bertin)
c *Herklotsichthys punctatus*
d *Sardinella longiceps* Valenciennes



a + b *Sardinella albella* (Valenciennes)
c *Sardinella gibbosa* (Bleeker)



a *Sardinella sirm* (Walbaum)
b *Hilsa kelee* (Cuvier)
c *Stolephorus indicus* (Van Hasselt)
d *Stolephorus commersonii* Lacépède



a *Thrissina baelama* (Forsskal)
b *Thryssa vitrirostris* (Gilchrist & Thompson)
c *Thryssa setirostris* (Brousssonet)

TABLE 3

A comparison of gillraker number at various lengths in *Herklotsichthys punctatus* Form *A* and *Herklotsichthys punctatus* Form *B*

(The mean of the ranges are placed in parenthesis)

Length Group mm.	*Number of Gillrakers* *H. punctatus A.* (45 fishes)	*H. punctatus B.* (44 fishes)
20– 29	—	23–29 (25.80)
30– 39	—	29–31 (30.50)
40– 49	—	—
50– 59	30–33 (31.75)	32–34 (33.00)
60– 69	30–33 (32.05)	32–35 (34.18)
70– 79	31–34 (32.88)	33–35 (34.25)
80– 89	31–34 (32.40)	33–36 (34.41)
90– 99	—	34–36 (35.00)
100–109	—	34–37 (35.37)
110–119	—	34–37 (35.33)

Rüppell's types of *C. punctata*. In the event, I have given greater emphasis to colouration than to other characters (e.g. body depth) and have thus equated *H. punctatus* form *A* with Rüppell's Red Sea *C. punctata*. I have examined brine-preserved Red Sea (Massawa) specimens in which the orange colouration was well demonstrated. Future work on specimens from other parts of the enormous range of *H. punctatus* may confirm the existence of two distinct species. The two forms share at least three East African localities (Shimoni, Tanga and the Zanzibar Channel), hence there is no significant geographical barrier to interbreeding and it would therefore be unwise to postulate subspecies unless more were known of possible isolating environmental factors.

Genus SARDINELLA Valenciennes, 1847

Sardinella Valenciennes, 1847: 28 (Type: *Sardinella aurita* Valenciennes).

Chan (1965) recognised fifteen Indo-Pacific species; five distinct species are here described from East African waters.

Key to the East African Species

1. Nine pelvic fin rays; more than 150 gillrakers on lower part of 1st gill arch . . . . *S. longiceps*
2. Eight pelvic fin rays; not more than 60 gillrakers on lower part of 1st gill arch:
   - (i) Abdominal scutes strongly keeled, sharp and exposed; abdomen highly compressed, not rounded; 43–60 gillrakers on lower part of 1st gill arch (at 51–144 mm. S.L.):
     - (a) Body depth 29.2–39.9% (mean 33.44%) in S.L. (at 51–123 mm S.L.); generally 12–13 (very rarely 14–15) post-pelvic scutes *S. albella*
     - (b) Body depth 19.8–31.6% (mean 26.5%) in S.L. (at 31–144 mm. S.L.); 14–16 post-pelvic scutes . . . . *S. gibbosa*
     - (c) Body depth about 28–31% in S.L. (at 75–105 mm. S.L.); 12–13 post-pelvic scutes; tips of caudal fin prominently dark grey to jet black . . . . *S. melanura**
   - (ii) Abdominal scutes feebly keeled, hardly exposed; abdomen smooth and rounded; 31–42 gillrakers on lower part of 1st gill arch (at 38.5–216.0 mm. S.L.):
     - (a) Gillrakers 40–42 on lower part of 1st gill arch (at 115–168 mm. S.L.); upper jaw (maxilla) almost or quite reaching the orbit through the vertical; base of dorsal fin about equidistant from snout and caudal base . . . . *S. sirm*
     - (b) Gillrakers 33 on lower part of 1st gill arch (at 199–216 mm. S.L.); upper jaw (maxilla) not nearly reaching the orbit through the vertical; base of dorsal fin much nearer to the caudal base than to the snout . . . . *S. leiogaster*

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*This species is known from adjacent areas but not as yet from East Africa.

SARDINELLA LONGICEPS Valenciennes

Plate 1d

Sardinella longiceps Valenciennes, 1847: (198) 273 (Type locality: Pondicherry); Regan, 1917: 379 (Mombasa); Fowler, 1956: 65 (Indo-Pacific specimens); Whitehead, 1965b: 349 (Gulf of Aden); Losse, 1966b: 173 (Mombasa).
Alausa scombrina: Valenciennes, 1847: 442 (Mahé, Seychelles).
Alose scombrina: Bleeker, 1875: 103 (Seychelles).
STANDARD COMMON NAME: Oil sardine.
VERNACULAR NAMES: *Dagaa la upapa* (Tanzania), *Simu ziwa* (Mombasa district), *Simu* (Kenya), *Dagaa* (small specimens, general).
DESCRIPTION: Based on thirteen fishes, 104.7–130.9 mm. standard length, from Formosa Bay; ten, 101.5–122.0 mm., from Mombasa; two, 106.–108.3 mm., from Zanzibar and two, 113.0–120.4 mm., from Dar-es-Salaam.

Dorsal iii-iv 13–15, total 17–19; pectoral i 14–16, pelvic i 8, anal ii–iii 13–16, total 15–18. Ventral scutes moderately keeled, 17–19 pre-pelvic, generally covered by scales; 14–15 (17) post-pelvic scutes strongly keeled, sharp, and exposed, total 32–34. Gillrakers long and setiform, about 168–250 on lower part of 1st gill arch. Branchiostegal rays 5. Scales moderately caducous, about 43–46 in lateral series.

Depth 20.3–23.5, head 27.3–30.5, snout 7.1–8.6, eye 5.0–6.2, post-orbital 11.9–13.9, inter-orbital 4.2–5.3, upper jaw 10.2–11.3, lower jaw 12.3–14.3, pectoral fin 15.2–17.1, pelvic fin 8.4–9.8, pre-dorsal 44.5–47.5, pre-pelvic 52.5–55.4, pre-anal (73.6) 77.5–79.9, caudal peduncle 7.0–7.8.

Body elongate, moderately compressed, dorsal and ventral profiles equally convex. Head 5–8% longer than the maximum body length. Upper jaw longer than the snout, the maxillary reaching about a third into the eye through the vertical. Operculum more than half as wide as long, the lower margin straight. Sub-operculum rectangular, the posterior border rounded. Dorsal fin slightly nearer to anal origin than to the pectoral base. Gillrakers long, about $\frac{2}{3}$ eye diameter in length. Scales narrowly imbricate, from shoulder with 2–4 incomplete, or more or less interrupted vertical striae, no perforations on posterior part of scales.
COLOUR: *Fresh*, dorsal surfaces bluish green, sides silvery. A yellow humeral patch continued in a narrow yellowish golden lateral stripe to caudal base, demarcating dorsal and lateral colouration. Top of head yellow or greenish yellow. Snout yellowish, dusky at tip. A dark patch at upper hind edge of operculum. Dorsal fin yellowish with dark margin; no dark spot at base of dorsal origin. Caudal yellowish, speckled dark brown to black, margin black. First pectoral ray black, rays 2–5 speckled black for $\frac{2}{3}$ of length. Other fins hyaline. At later post-mortem the yellow colours fade, and the lateral band may become dark or almost black.

In alcohol, dorsal surfaces bluish green or brown, sides silvery or golden. All dark markings retained and generally more pronounced, rest faded except lateral band which may be retained as a light band below dark dorsal colouration.
SIZE: 131 mm. S.L., weight 34.7 gm. (Formosa Bay); 166 mm. in the eastern Indo-Pacific (Li-Kwan-Ming, 1959).
DISTRIBUTION: East African coast south to Dar-es-Salaam (recorded from Formosa Bay, Mombasa, Shimoni, Zanzibar and Dar-es-Salaam), in waters 1–21 fathoms in depth, in bays and over shallow banks, not found elsewhere in this area. Specimens were caught at the beginning of the northeast monsoon (November to December 1965) in the Zanzibar Channel, in Formosa Bay and through the northeast monsoon period (November to January 1964/65) off Mombasa. The maximum abundance of this species in the Indian Ocean is in areas of upwelling and biologically rich waters. The occurrence in East African waters may be associated with the reported inflow of the relatively rich Somalia Current during the northeast monsoon (Williams, 1964). The occurrence of specimens in the Zanzibar Channel, where only four were recorded (Nov./Dec. 1965), is of considerable interest as this species has not been known previously from the south of Mombasa (Lat. 04° South), although large samples of *Sardinella* were previously examined by the author from purse-seine and stick-held dipnet catches made in the Zanzibar area. The occurrence of *S. longiceps* in East African waters may be a useful indicator of the inflow of biologically rich waters. The species generally avoids areas where the thermocline is deep (as off East Africa) and where biologically poor surface waters are piled up along the eastern continental coasts (Rosa & Laevastu, 1960).
RANGE: Eastern coast of Africa from the Gulf of Aden to Dar-es-Salaam; Seychelles. Elsewhere, widely distributed in the Indian and Pacific Oceans; recorded from Arabia, India, Ceylon, Andamans, E. Indies and the Philippines.

SARDINELLA ALBELLA (Valenciennes)

Plate 2a,b

Kowala albella Valenciennes, 1847: 362 (Type locality: Pondicherry).
Alosa kowal: Günther, 1866: 123 (Zanzibar); Sauvage, 1891: 627 (Zanzibar).

Clupea kowal: Günther, 1868: 450 (Zanzibar).
Sardinella perforata: Regan, 1917: 382 (Indian Ocean); Fowler, 1956: 65 (Indo-Pacific specimens); Sanches, 1963: 17, fig. 1 (Inhaca, Mozambique); Losse, 1964: 11 (Zanzibar Channel); *Idem*, 1966a: 89 (Zanzibar).
Sardinella bulan: Whitehead, 1965b: 250 (Gulf of Aden); Losse, 1966b : 173 (East Africa; Zanzibar, Pangani estuary, Tanga, Mombasa); *Idem*, 1966c : 51 (Zanzibar Channel).

The types of *Clupalosa bulan* and *Kowala albella* have been redescribed by Whitehead (1964c; 1967).
STANDARD COMMON NAME: Deep-bodied sardine.
VERNACULAR NAMES: *Dagaa la upapa* (Zanzibar, Dar-es-Salaam), *Simu* (Kenya), *Simu koko* (Mombasa; Swahili *koko*=mongrel, i.e. mongrel sardine), *Dagaa* (small specimens, general).
DESCRIPTION: Based on four fishes, 99.7–123.2 mm. standard length, from Mombasa; two, 58.1–65.3 mm., from Tanga; one, 77.3 mm., from the Pangani estuary and twenty-eight, 51.0–113.3 mm., from the Zanzibar Channel. Depth measurements, scute and gillraker counts on ten further fishes, 79.7–116.5 mm., from the Zanzibar Channel.

Dorsal iv (14) 15–16, pectoral i 13–15 (16), pelvic i 7, anal ii–iii 17–20, total (19) 20–22 (23). Ventral scutes strongly keeled, sharp and exposed, 17–18 pre-pelvic, 12–13 (14–15) post-pelvic, total 30–31 (32–33). Gillrakers, 46–55 on lower part of 1st gill arch (at 51.0–123.2 mm. S.L.), the number increasing slightly with length of fish. Branchiostegal rays 5. Scales caducous, about 39–43 (pockets) in lateral series.

Depth 29.2 (at 51 mm.)–39.9 (at 111 mm.; mean 33.44%), head 23.3–27.6, snout 5.7–8.9, eye 6.1–8.1, post-orbital 8.2–9.9, upper jaw 9.9–11.3, pectoral fin 18.3–21.7, pelvic fin 10.6–12.3, pre-dorsal 42.2–47.5, pre-pelvic 49.2–54.1, pre-anal 75.1–82.1. (For the mean of these values see Table 4).

Body very strongly compressed, much more than in all other East African *Sardinella*. Ventral profile convex, dorsal profile almost a straight line. Head 6% or more shorter than the maximum body depth. Upper jaw longer than the snout, reaching about $\frac{1}{5}$ to almost $\frac{1}{2}$ into the eye, through the vertical. Operculum about $2\frac{1}{2}$ times as long as wide, the lower margin oblique. Sub-operculum rectangular, about twice as long as wide, the posterior border oblique. Dorsal fin slightly nearer to snout than to the caudal base, or about equidistant. Pelvic origin slightly nearer to pectoral base than to the anal origin or almost equidistant. Gillrakers short, about $\frac{1}{2}$ eye diameter in length. Scales (from shoulder) crenulate with 3–4 interrupted vertical striae and numerous round and oval perforations on posterior part of scale.
COLOUR: *Fresh*, dorsal surfaces green, bluish where scales are lost; sides and belly silver. Humeral spot absent, at the most a few minute, scattered black spots are evident. Faint golden lateral stripe present in large specimens (scales lost). Tip of snout dusky. Dorsal fin tinged faintly yellow, mainly grey. A black spot at base of anterior dorsal rays; fin dusky at margins. Caudal fin dusky, darker (almost black in some specimens) at margins. First ray of pectoral fin occasionally with dark markings, generally these are absent. Other fins colourless.

In alcohol, dorsal surfaces greenish-brown, sides silvery. Dark markings retained, rest faded.
SIZE: 123.2 mm. S.L. (Mombasa), weight 34 gm. (♀, 122 mm. F.L.).
DISTRIBUTION: Entire East African coast (recorded from Formosa Bay, Malindi, Mombasa, Kilifi, Tanga, Pangani estuary, the entire Zanzibar and Mafia Channels), in shallow bays (juveniles) in the vicinity of estuaries, but also further offshore (adults only) in waters 20 fathoms in depth (Zanzibar Channel). A neritic species which was the only *Sardinella* frequently caught in estuaries (by trawl) and generally occurred in abundance only in the shallow waters close to the shore. The species was present throughout the year and abundant in the Zanzibar Channel during July, August and shortly following the rainy seasons in April and November.
RANGE: Eastern coast of Africa from the Gulf of Aden to Mozambique (Lourenco Marques and Inhaca Island); Madagascar. Elsewhere, widely distributed in the Indian and Pacific Oceans; recorded from the East Indies, Philippines, Siam, Micronesia and Polynesia.
REMARKS: Three specimens from Mombasa (110.6–123.2 mm. S.L.; Plate 2b) are remarkable for their great body depth (36.0–39.9% in S.L.) and short head length (23.3–24.2% in S.L.). In these characters they resemble previous descriptions of *S. brachysoma* (Bleeker). Chan (1965) however distinguished *S. brachysoma* by the groove patterns on the scales, the vertical striae becoming continuous across the scale in the posterior scales but remaining incomplete in all scales in *Sardinella albella*. This distinction has been further emphasised by Whitehead (1967, fig. 4) in a comparison of the type of *Kowala albella* with typical specimens of *S. brachysoma*. The three Mombasa specimens have the vertical striae interrupted at the centre of the scale, even in scales from the caudal peduncle, and so conform to the *albella* and not the *brachysoma* pattern illustrated by Whitehead. Whitehead (*loc. cit.*) also showed that the name *albella* had priority over the name *bulan*; in some of the earlier literature the species has been referred to as *Sardinella perforata* (Cantor), but this is also a synonym of *albella*.

These deep-bodied specimens from Mombasa are all females with gonads in a mature condition. This character of extreme depth in large mature females was frequently evident in this and the following species, *S. gibbosa*. Depth generally increased with length and hence it is not always a reliable character for identification of the species.

SARDINELLA GIBBOSA (Bleeker)

Plate 2c

Clupea gibbosa Bleeker, 1849b: (69) 72 (Type locality: Macassar).
?*Clupea tembang:* Jatzow & Lenz, 1899: 526 (Zanzibar).
Sardinella sindensis: Regan, 1916 : 167 (Durban); Gilchrist & Thompson, 1917 : 297 (on Regan, references).
Sardinella gibbosa: Regan, 1917a : 383 (Mombasa, Indian Ocean); *Idem*, 1917b : 458 (Durban); Barnard, 1925: 113 (Natal).
Sardinella jussieu: Bonde, 1933 : 353 (Zanzibar); *Idem*, 1934 : 437, (Zanzibar); Fowler, 1934 : 365, fig. 5 (Durban); *Idem*, 1941 : 67 (Indo-Pacific specimens); Smith, 1949–1965 : 92 (Natal); Baissac, 1950 : 10 (Mauritius); Allfree & Bailey, 1951 : 74 (Kenya); Baissac, 1951 : 128 (Mauritius); Fourmanoir, 1957 : 9 (Madagascar); Sanches, 1963 : 18, fig. 2 (Inhaca, Mozambique); Losse, 1964 : 11 (Zanzibar Channel); Whitehead, 1965b : 252 (Red Sea, Gulf of Aden); Losse, 1966a : 89 (Zanzibar); *Idem*, 1966b : 173 (East Africa; Dar-es-Salaam, Zanzibar, Tanga, Mombasa, Malindi); *Idem*, 1966c : 51 (Zanzibar Channel).
STANDARD COMMON NAME: Common sardine.
VERNACULAR NAMES: *Dagaa la upapa* (Tanzania), *Simu* (Kenya coast), *Simu ziwa* (Mombasa district), *Dagaa* (small specimens, general).
DESCRIPTION: Based on eleven fishes, 98.3–144.0 mm. standard length, from Formosa Bay; fifteen, 53.5–142.6 mm., from Mombasa and forty-two, 31.0–140.6 mm., from the Zanzibar Channel.

Dorsal iii–iv (13) 14–15 (16), total (17) 18–19 (20), pectoral i 14–15 (16), pelvic i 7, anal ii–iii (iv) (15) 16–18, total (18) 19–21. Ventral scutes strongly keeled, sharp and exposed, (16) 17–18 (19) pre-pelvic, 14–15 (16) post-pelvic, total (31) 32–33 (34). Branchiostegal rays 5. Gillrakers of moderate length, half as long as eye diameter, 38–58 on lower part of 1st gill arch (at 31–144 mm. S.L.), increasing in number with length of fish.

Body depth variable, 19.8–31.6 (mean 26.55, at 31–144 mm. S.L.), head 23.4–28.3, snout 6.4–8.8, eye (5.2) 5.6–8.0, post-orbital 8.2–10.2, upper jaw 9.1–11.5, pectoral fin 15.6–19.5, pelvic fin 7.9–11.7, pre-dorsal 42.3–48.0, pre-pelvic 46.3–52.0 (53.6), pre-anal 72.2–80.5 (85.5–87.8), caudal peduncle 7.3–9.4. (The mean of these values are shown in Table 4).

Body strongly compressed but less than in the preceding species, *S. albella.* Ventral profile rather more convex than the dorsal, which is almost a straight line. Head at the most 4% shorter than maximum body depth (large females, *c.f.* preceding species), generally 1–4% longer than the depth of the body. Upper jaw longer than the snout, reaching almost half into the eye through the vertical. Operculum about 2½ times as long as wide, the lower margin straight or slightly oblique. Sub-operculum rectangular, the posterior border oblique. Dorsal fin base about equidistant from the snout and the caudal base. Pelvic origin slightly nearer to pectoral base than to the anal origin or about equidistant. Scales (from shoulder) crenulate, with 4–5 interrupted vertical striae and a number of perforations on the posterior part of the scales.
COLOUR: *Fresh*, (scales fallen), dorsal surfaces greenish blue, sides and belly silvery. A yellowish or dark (almost black) humeral spot continued in a very faint yellowish line to caudal base. Tip of snout yellowish. Lower jaw bright yellow, minutely speckled black. A black spot at base of anterior dorsal rays, dorsal fin yellowish, dorsal third dusky. Caudal fin colourless, yellowish or dusky with darker margins. First ray of pectoral fin speckled black. Other fins colourless.

In alcohol, dorsal surfaces brown, greenish-blue or dark, sides silvery. Black markings retained; humeral spot and spot at dorsal origin often prominent, rest faded. Caudal fin very variable, from colourless and dusky with darker margins to almost entirely black.
SIZE: 144 mm. S.L. (Formosa Bay); 163 mm. F.L., weight 59.5 gm. (♀, Formosa Bay).
DISTRIBUTION: Entire East African coast (recorded from Formosa Bay, Malindi, Mombasa, Shimoni, Zanzibar Channel and Mafia Channel south to Kilwa), in the shallow coastal water within the 100 fathom contour, in bays and harbours (Mombasa). *S. gibbosa* is the most abundant sardine in the East African area and occurred throughout the year. Seasonal abundance was marked during the northeast monsoon and also during and following the rainy seasons.
RANGE: Eastern coast of Africa from the Red Sea to Durban; Madagascar, Mauritius. Elsewhere, widely distributed in the Indian and Pacific oceans.
REMARKS: *Sardinella gibbosa* from E. African waters exhibit a wide range of most meristic characters.

Two populations may occur in this area; one abundant during the southeast monsoon, the other during the northeast monsoon period. These populations appeared to differ slightly in mean body depth and mean gillraker number, but extensive studies of large series will be necessary to clearly define the characteristics.

As in the preceding species, body depth is extremely variable, the greatest depth being recorded in mature females caught offshore during the latter part of the southeast monsoon (September/October) and hence this is not always a reliable character in differentiating *S. gibbosa* from *S. albella.* Values for body measurements (Table 4) demonstrate, however, that the only marked proportional difference between these two species is body depth. In the meristic characters differences are shown

in the number of branched anal rays and the number of abdominal scutes, although there is some overlap.

This species was known as *Sardinella jussieu* (Lacépède) by certain earlier authors. Recently Whitehead (1967) has shown that the name *jussieu* is now almost impossible to identify with certainty, and he recommended that it be supressed as a *nomen dubium*.

TABLE 4

Proportional measurements and meristic characters of *Sardinella albella* and *Sardinella gibbosa*

	Sardinella albella (39 fishes)	*Sardinella gibbosa* (73 fishes)
Standard length	51–123 mm.	31–144 mm.
In % of S.L.	*mean*	*mean*
Body depth	33.44	26.55
Head length	25.71	25.38
Snout length	7.25	7.55
Eye diameter	7.23	6.57
Post-orbital distance	8.99	9.09
Upper jaw length	10.62	9.91
Pectoral fin length	19.83	17.57
Pelvic fin length	11.43	10.03
Pre-dorsal distance	45.06	45.04
Pre-pelvic distance	51.51	50.19
Pre-anal distance	77.71	78.47
Dorsal rays: simple	iv	iii–iv
branched	(14)15–16	(13)14–15(16)
Anal rays: simple	ii–iii	ii–iii(iv)
branched	17–20	(15)16–18
Abdominal scutes	17-18+12–13(14–15)	(16)17–18(19)+14–15(16)
Gillrakers	46–55	38–58

SARDINELLA MELANURA (Cuvier)

Clupea melanura Cuvier, 1829 : 318 (on var.du *Clupanodon jussieu* of Lacépède, 1803 : pl. 11, fig. 3; locality: Asia).

This species was not recorded from East African waters but it is known from the Red Sea, Gulf of Aden (as *Herklotsichthys vittatus*; Whitehead, 1965b), Mozambique Channel and Natal (Fowler, 1925).

SARDINELLA SIRM (Walbaum)

Plate 3a

Clupea sirm Walbaum 1792 (on Forsskâl, 1775 : 17; Arabia); Peters, 1855 : 268 (Mozambique); Günther, 1868 : 425 (Zanzibar); Klunzinger, 1871 : 598 (Mozambique).
Alosa sirm: Günther, 1866 : 123 (Zanzibar); Sauvage, 1891 : 527 (Zanzibar).
Clupea punctata: Günther, 1868 : 412 (Zanzibar).
Sardinella sirm: Regan, 1917 : 385 (Zanzibar, Indian Ocean); Smith, 1955 : 307 (Aldabra); *Idem*, 1963 : 8, pl. 4 K (Seychelles); Losse, 1964 : 11c Zanzibar Channel); Whitehead, 1965b : 256 (Red Sea, Gulf of Aden); Losse, 1966a : 89 (Zanzibar); *Idem*, 1966b : 174 (East Africa; Dar-es-Salaam, Zanzibar, Mombasa); *Idem*; 1966c : 51 (Zanzibar Channel).
Sardinella leiogaster: Fourmanoir, 1961 : 84 (Madagascar).
STANDARD COMMON NAME: Arabian sardine.
VERNACULAR NAMES: *Dagaa la upapa* (Tanzania), *Simu* (Kenya), *Simu arabuni* (Mombasa district), *Dagaa* (small specimens, general) *Simu dudumi* (Mombasa, very small specimens; may also refer to very small specimens of other *Sardinella*, i.e. Swahili *dudu*=insect).

DESCRIPTION: Based on eighteen fishes, 62.7–167.8 mm. standard length, from the Zanzibar Channel and five, 44.1–62.5 mm., from Mombasa. Depth measurements and gillraker counts on eight further fishes, 38.5–147.4 mm., from the Zanzibar Channel and twelve, 42.3–67.6 mm., from Mombasa.

Dorsal iii–iv 12–15, total (15–16) 17–19, pectoral i 15–17, pelvic i 7, anal iii (iv) (14–15) 16–18, total (19) 20–22. Abdominal scutes feebly keeled, 16–18 pre-pelvic, (8) 13–14 post-pelvic, total (25–29) 30–31 (32). Gillrakers, 31–42 on lower part of 1st gill arch (at 38.5–167.8 mm. S.L.), the number increasing with length of fish (Table 5). The gillraker number does not increase significantly in fish of 160 mm. and above. Whitehead (1965b) recorded 45 gillrakers in a single specimen from the Red Sea/Gulf of Aden area. Scales very caducous, about 39–41 (pockets) in lateral series. Branchiostegal rays 5.

TABLE 5

Gillraker number at various lengths in *Sardinella sirm*

Standard length mm.	*Gillraker range*	*Gillraker mean*
	East African Material (43 fishes)	
38.5–39.9	31–32	31.66
40.0–44.1	32-35	33.75
51.0–59.0	36–38	36.55
61.1–69.6	36–40	37.60
78.5	39	39.00
92.1	39	38.00
114.7	40	40.00
143.2–149.8	40–41	40.50
152.0–154.6	41–42	41.50
167.8	42	42.00
	Malagasy Material (*EAMFRO*. 1966.2.1) (5 fishes)	
157.7–191.5	42–43	42.40

Depth 18.7–23.1, head 23.7–27.4, snout 6.7–9.1, eye 5.8–7.5, post-orbital 8.3–9.7, upper jaw 8.5–11.5, pectoral fin 15.5–17.8, pelvic fin 9.0–11.3, pre-dorsal 44.2–47.6, pre-pelvic 48.0–50.6, pre-anal 72.0–80.6. (The mean of these values are shown in Table 6).

Body elongate, moderately compressed; belly smooth and rounded. Dorsal and ventral profiles equally convex. Head about 2.5–5% longer than the maximum body depth. Upper jaw slightly longer than the snout, the maxillary not quite reaching to the anterior border of the orbit, or rarely, just level with anterior border of the orbit through the vertical. Operculum about 2¾ times as long as wide, the lower margin oblique. Sub-operculum rectangular, the posterior border rounded. Dorsal fin base equidistant from the snout and the caudal base, dorsal origin much nearer to snout than to the caudal base. Pelvic origin beneath anterior third of dorsal fin. Scales (from shoulder) with up to 5 interrupted vertical striae, poorly developed in large specimens; posterior scale borders with slight indentation, not markedly crenulate, and a few small perforations.

COLOUR: *Fresh* (scales fallen) at 45–62 mm., dorsal surfaces greenish-blue, sides silvery. Humera spot greenish-yellow followed by a lateral series of such spots to caudal base. Black spot at base of dorsal origin. Caudal base yellowish, fin minutely speckled black. Snout and lower jaw yellowish, tips dusky.

At 100 mm. and above, dorsal surfaces blue-green, sides and belly silvery. Humeral spot blue-black followed by a series of up to 13 round blue-black lateral spots to caudal base which tend to form a stripe posteriorly. Anterior base of dorsal fin yellowish; a black spot at base of anterior (simple) rays. Caudal dusky, darker at margins. Other fins colourless.

In alcohol, dark markings generally retained, rest faded. In adults the lateral row of blue spots generally becomes indistinct, as also in some juveniles (due to formalin).

SIZE: 200 mm. F.L. and a weight of 109 gm. (♀, Zanzibar Channel); 206 mm. F.L. and 116.8 gm. in Madagascar (Nosy-Bé).

DISTRIBUTION: Entire East African coast (recorded from Formosa Bay, Malindi, Mombasa, Kilifi, Tanga, Zanzibar Channel and Mafia Channel), in bays, harbours (juveniles only) and shallow

waters within the 100 fathom contour. Seasonal abundance occurred during the northeast monsoon; the species was uncommon in the coastal waters for the greater part of the southeast monsoon period. A more offshore species than all other *Sardinella* in this area, it was abundant only over the shallow water banks of the southern portions of both the Mafia and Zanzibar Channels. Adult fish appeared in November and departed before March, juveniles remained in the coastal waters in small numbers.

The species was observed underwater in groups of 8–10 (juveniles) frequently swimming together with *Herklotichthys punctatus* Form *A*, in and around coral reef areas of the Zanzibar Channel.

RANGE: Eastern coast of Africa from the Red Sea to Mozambique; Madagascar, Aldabra, Seychelles. Elsewhere, widely distributed in the Indian and Pacific oceans; East Indies, Philippines, China, Micronesia and Polynesia.

SARDINELLA LEIOGASTER Valenciennes

Sardinella leiogaster Valenciennes, 1847 : 270.
? *Sardinella clupeoides:* Fowler, 1941 : 620 (Red Sea).
STANDARD COMMON NAME: Short-jawed sardine, distinguishes this species from the longer-jawed *Sardinella sirm*.
VERNACULAR NAME: *Simu* (Kenya).
DESCRIPTION: Based on two fishes, 199–216 mm. standard length, from Malindi (Kenya).

Dorsal iv–v 14–15, pectoral i 15–16, pelvic i 7, anal 19 (2–3 of which appear to be simple rays; fins damaged), abdominal scutes very feebly keeled, 17 pre-pelvic, 14 post-pelvic. Gillrakers, 33 on lower part of 1st gill arch. Branchiostegal rays 5. Scales very caducous, about 39 (pockets) in lateral series.

Depth 21.6–22.6, head 23.2–23.5, snout 7.2–7.3, eye 5.6–6.0, post-orbital 8.9–9.1, upper jaw 7.0, lower jaw 8.5–8.9, pectoral fin 13.4–14.6, pelvic fin 8.4–8.8, pre-dorsal 49.4–51.4, pre-pelvic 49.4–50.4, pre-anal 77.0–77.6.

Body elongate, very moderately compressed; belly smooth and rounded. Dorsal and ventral profiles equally convex. Head at the most 2% longer than the maximum body depth. Upper jaw shorter than the snout, the maxillary not nearly reaching the anterior border of the orbit through the vertical. Operculum about 2–2½ times as long as wide, the lower margin oblique. Sub-operculum rectangular, the posterior border oblique. Dorsal fin base much nearer to the caudal base than to the snout; dorsal origin slightly nearer to snout than to the caudal base. Pelvic origin slightly in front of, or under origin of dorsal fin. Scales with about 4–5 interrupted vertical striae; posterior scale borders not crenulate and without indentations. A few small, round perforations are present on the posterior part of scales.

COLOUR: *In formalin* (scales fallen), dorsal and dorso-lateral surfaces bluish-brown without a clear demarcation from light grey to whitish ventral and ventro-lateral colouration. No lateral series of spots evident. Snout dark brown, tip of lower jaw blackish. Dorsal and caudal fins evenly dusky. A marked black patch on inner surfaces (axil) of pectoral fins. Other fins colourless.
SIZE: 216 mm. S.L. (Malindi).
DISTRIBUTION. The two specimens described above are the first record of this species from the Western Indian Ocean; they were collected on 23 May 1966 during the heavy rains, from a single catch of 500 lb. sardine (including *Sardinella sirm*) made by shore-seine fishermen. No conclusions can be drawn from this isolated recorded occurrence of the distribution of this species in East African waters.
RANGE: East African coast (Malindi only). Elsewhere, ?Red Sea (see REMARKS), mainly the Pacific and adjacent seas; East Indies, Philippines, Queensland coast of Australia and Japan.
REMARKS: Bertin (1944b), after examining type material, concluded that *S. leiogaster* is identical to and has priority over *S. clupeoides* (Bleeker) 1849. Fowler (1941) listed *S. clupeoides* from the Red Sea on the basis of a single specimen, 126 mm. S.L., and recorded "32?" gillrakers. Whitehead (1965b) tentatively placed Fowler's specimen in the synonym of *S. sirm*. As shown in Table 5, gillraker number increases considerably with size in *S. sirm*, and assuming a similar occurrence in Red Sea specimens, a fish of 126 mm. is large enough to have an adult count (40 or above). Hence it must be concluded that Fowler's specimen may be referred to *S. leiogaster*. Specimens in the O.R.S.T.O.M. collection at Nosy-Bé which Fourmanoir (1961) placed in *S. leiogaster* are *S. sirm*.

This species is clearly differentiated from *S. sirm* by possessing fewer gillrakers (33 *c.f.* 40–42 in *S.sirm* of comparable size), a very short upper jaw (7.0% *c.f.* 9.61% in S.L. in *S. sirm*), which does not nearly reach the anterior border of the orbit through the vertical, and in the position of the dorsal fin. Other differences are the relative lengths of the head, snout, pectoral fin, pelvic fin (Table 6) and colouration.

Both *S. sirm* and *S. leiogaster* have been placed in the subgenus *Amblygaster* by Chan (1965) and other previous workers. *Amblygaster* differs from the subgenus *Sardinella* in the arrangement of the median pre-dorsal scales and in the degree of compression of the ventral keels. In overall appearance the species have a greater resemblance to the pilchards (*Sardina*, *Sardinops*) than to the true sardines (*Sardinella*).

TABLE 6

A comparison of proportional measurements and meristic characters of *Sardinella sirm* and *Sardinella leiogaster*.

	Sardinella sirm (23 fishes)	*Sardinella leiogaster* (2 fishes)
Standard length	52–168 mm.	199–216 mm.
In % of S.L.	*mean*	*mean*
Body depth	21.19	22.10
Head length	25.66	23.35
Snout length	7.98	7.25
Eye diameter	6.58	5.80
Post-orbital distance	9.04	9.00
Upper jaw length	9.61	7.00
Pectoral fin length	16.54	14.00
Pelvic fin length	10.07	8.60
Pre-dorsal distance	45.76	50.04
Pre-pelvic distance	49.23	49.90
Pre-anal distance	76.78	77.30
Dorsal rays (total)	(15–16)17–19	19
Anal rays (total)	(19)20–22	19
Abdominal scutes	16–18+(8)13–14	17+14
Gillrakers	31–42 (40–42, at 115–168 mm.)	33

Sub-family ALOSINAE

Genus HILSA Regan, 1917

Hilsa Regan, 1917 : 303 (Type: *Paralosa durbanensis* Regan, *ex* Durban).
Paralosa Regan (*non Paralosa* Bleeker), 1916 : 167 (Type: *Clupea durbanensis* Regan).
Macrura Fowler (*non Macrura* Van Hasselt), 1941 : 623 (Type: *Clupea kelee* Cuvier).

The Indo-Pacific Alosinae have been recently revised by Whitehead (1965a). A single species in East African waters.

HILSA KELEE (Cuvier)

Plate 3b

Clupea kelee Cuvier, 1829 : 320 (name in footnote, based on *Kelee* Russell, 1803 : 75, pl. 195; Type locality: Vizagapatam).
Alosa chapra: Günther, 1866 : 123 (Zanzibar); Sauvage, 1891 : 527 (Zanzibar).
Clupea ilisha: Günther, 1868 : 445 (Zanzibar); Angot, 1950 : 180 (Madagascar).
Clupeonia ilisha: Sauvage, 1891 : 527 (Madagascar).
Clupea durbanensis: Regan, 1906 : 4, pl. 4 (Durban); Gilchrist & Thompson, 1908–11 : 268 (Durban, Natal); Gilchrist, 1913 : 59 (Natal).
Paralosa durbanensis: Regan, 1916 : 167 (Durban); Gilchrist & Thompson, 1917 ; 297 (references).
Hilsa kanagurta: Regan, 1917 : 304 (Zanzibar); Fowler, 1935 : 51 (Beira).
Hilsa durbanensis: Barnard, 1925 : 111 (Natal coast); *Idem*, 1927 : 101 (on Fowler, Delagoa Bay); Fowler, 1934 : 411 (Natal); *Idem*, 1935 : 365 (Durban beach).
Macrura durbanensis: Fowler, 1941 : 628 (Durban).
Macrura kelee: Allfree & Bailey, 1952 : 74 (Kenya); Fowler, 1956 : 69 (Indo-Pacific specimens); Smith, 1949–1965 : 90, fig. 109 (Natal); *Idem*, 1958 : 131 (Inhaca, Mozambique).
Macrura kanagurta: Fourmanoir, 1957 : 8, fig. 1 (Madagascar); Kiener, 1961 : 356, fig. 56 (Madagascar); *Idem*, 1963 : 81, 85, pl. 49 (Madagascar, west coast).
Hilsa kelee: Whitehead, 1965a : 129, fig. 8 (Revision, synonymy; Sabaki mouth, Zanzibar, Durban); *Idem*, 1965b : 257 (Gulf of Aden); Losse, 1966b : 174 (East Africa; Ruvu estuary, Pangani estuary, Mombasa, Malindi, Sabaki estuary).
STANDARD COMMON NAME: River Shad.

VERNACULAR NAMES: *Makrange* (Mombasa), *Pawali* (Kenya coast).
DESCRIPTION: Based on five fishes, 71.5–96.2 mm. standard length, from Formosa Bay; two, 48–78 mm., from the Sabaki estuary (Malindi); three, 158–163 mm., from Mombasa; two, 55.0–55.5 mm., from the Pangani estuary; one, 62 mm., from the Ruvu estuary (at Bagamoyo) and one, 130 mm., from Zanzibar (a skin).

Dorsal iv (13) 14, pectoral i 13–14, pelvic i 7, anal ii–iii 18–20, total 20–22. Ventral scutes strongly keeled, sharp and exposed, 16 (17) pre-pelvic, 13 post-pelvic. Gillrakers long, setiform with very well developed, sharp, conical spines on their inner borders, 74–177 on lower part of 1st gill arch. Gillraker number increases considerably with increase in size (Table 7), a specimen of 231 mm. from Natal (EAMFRO. 1965.2.91) has about 187 gillrakers. Branchiostegal rays 6. Scales adherent, 37–42 in lateral series.

TABLE 7

Gillraker numbers at various lengths in *Hilsa kelee*

Standard length mm.	*Gillraker range*
(14 fishes)	
50.0– 55.5	74–76
62.0	87
71.5– 78.0	94–103
80.6– 85.9	108–117
96.2	126
158.0–163.0	164–177
*231.0	ca.187

*Specimen from Natal.

Depth 33.2–40.3, head (28.1) 30.9–35.1, snout 7.0–8.9, eye 7.1–9.7, post-orbital 12.4–15.8, inter-orbital 6.6–9.5, upper jaw (12.2) 13.4–16.0, lower jaw (14.2) 16.1–20.2, pectoral fin 61.4–22.0, pelvic fin 10.6–14.0, pre-dorsal 43.6–49.0, pre-pelvic (49.6) 50.4–55.3, pre-anal 73.8–80.5, caudal peduncle 10.5–11.4.

Body very strongly compressed. Ventral profile much more convex than the dorsal. Snout blunt, about eye diameter or a little less in length. Upper jaw with a prominent, deep, median notch. Tip of lower jaw folds completely within the upper. Maxilla large, longer than the snout, reaching one half to two-thirds into the eye through the vertical. Two supra-maxillae, the first large, the second with a short anterior shaft. Teeth absent in adults, a few teeth occasionally present on the tongue in juveniles. Fronto-parietal striae numerous and well developed. Operculum venulose, about twice as high as wide, the lower margin oblique. Pre-operculum and sub-operculum with rounded posterior borders. Dorsal origin nearer to snout than to the caudal base; dorsal fin base about equidistant from the snout and the caudal base. Pelvic axillary scale about two-thirds length of fin; pectoral axillary scale absent. Dorsal and anal fins with scaly sheaths. Pseudobranch exposed, about eye diameter in length. Gillrakers long, about equal to snout in length, easily visible when the mouth is opened. Scales adherent, with up to nine vertical striae. The two posterior striae are often complete, the rest interrupted. Posterior scale border crenulate with oval perforations,
COLOUR: *Fresh*, at 158–163 mm. S.L., dorsal surfaces greenish blue, sides silvery. Shoulder venulose with a prominent black humeral patch. Dorsal surface of head greenish-golden. Iris silver, a green to golden sheen on dorsal border. Dorsal fin yellowish, minutely speckled black; rays i-ii black, other rays black at dorsal fifth of fin. Caudal yellowish, margins black. Other fins colourless.

At 55–62 mm., as above except that a series of up to ten black spots are generally distinct along the side, the humeral spot being the darkest. Dorsal and caudal fins brownish.

In alcohol, dorsal surfaces brown to grey, flanks silvery to light brown (due to formalin). Dorsal and caudal fin with black markings fainter, but generally retained. Humeral spot and lateral series of spots (in juveniles) more or less distinct.
SIZE: 163 mm. S.L. (Mombasa), 231 mm. in Natal (Specimen in EAMFRO collection).
DISTRIBUTION: Entire East African coast (recorded from Formosa Bay, Sabaki estuary, Malindi, Mombasa, Pangani estuary and river, Ruvu estuary at Bagamoyo and Zanzibar), in river mouths and estuaries; not found elsewhere in this area, The species was seasonally abundant (Mombasa district) during and shortly following the light and heavy rains (i.e. November-December and March-April).
RANGE: Eastern coast of Africa from the Gulf of Aden to Natal; Madagascar. Elsewhere, Indo-Pacific to Burma and Siam.

Sub-family PRISTIGASTERINAE

Genus PELLONA Valenciennes, 1847

Pellona Valenciennes, 1847 : (218) 300 (Type: *Pellona orbignyana* Valenciennes).
A single Indo-Pacific species.

PELLONA DITCHELA Valenciennes

Pellona ditchela Valenciennes, 1847: (228) 314 (on *Ditchelee* Russell, 1803: 72 pl. 188; Type locality: Vizagapatam); Fowler, 1941: 648 (Natal); Smith, 1949–1965: 93, fig. 118 (Natal); Allfree & Bailey, 1952: 74 (Kenya); Fourmanoir, 1953: 92 (Madagascar), *Idem*, 1957: 10, fig. 3 (Madagascar); Smith, 1958: 131 (Inhaca, Mozambique); Kiener, 1963: 81, 86 pl. 51 (Madagascar); Losse, 1966b: 175 (East Africa; Ruvu estuary, Zanzibar, Pangani estuary, Mombasa, Malindi, Formosa Bay).
Pellona ditchoa: Günther, 1866: 122 (Kiangani River, East Africa); *Idem*, 1868: 455 (Zanzibar, East Africa); Sauvage, 1891: 527 (Zanzibar).
Pellona indica: Günther, 1868: 455 (Zanzibar); Pfeffer, 1894: 69 (East Africa); *Idem*, 1897: 62 (German East Africa).
Ilisha natalensis: Gilchrist, 1913: 60 (Natal); Gilchrist & Thompson, 1917: 298 (references).
Pellona natalensis: Gilchrist & Thompson, 1908–11: 202 (South Africa); Barnard, 1925: 110, pl. 7. fig. 1 (Natal).
Ilisha indica: Boulenger, 1909: 163, fig. 130 (East coast of Africa).
Ilisha ditchela: Fowler, 1923: 36 (Madagascar).
Neosteus ditchela: Norman, 1923: 17 (East Africa).
Ilisha hoevenii: Fowler, 1925: 195 (Delagoa Bay, Natal).
Pellona hoevenii: Barnard, 1927: 1018 (Natal, Delagoa Bay).
STANDARD COMMON NAME: Ditchela.
VERNACULAR NAMES: *Chaa* (general), *Simu* (Shimoni), *Simu koko* (Malindi; Swahili, *koko* = mongrel).
DESCRIPTION: Based on one fish, 127.0 mm. standard length, from Zanzibar; thirty-five, 30.0–70.0 mm., from the Pangani estuary; one, 125.0 mm., from the Ruvu estuary at Bagamoyo; four, 46.0–98.6 mm., from Mombasa and six, 100.0–125.0 mm., from Formosa Bay.

Dorsal iii 14 (16), pectoral i 14–15, pelvic i 6–7, anal iii-iv (34) 36–37 (38) 39–40 (41–42). Ventral scutes strongly keeled, sharp and exposed, from isthmus to anus, 18–20 pre-pelvic, 8 (9) post-pelvic, total 26–28. Gillrakers, 22–25 on lower part of 1st gill arch. Branchiostegal rays 6. Scales caducous, about 39–41 (pockets) in lateral series.

Depth 28.2–37.8, head (24.6) 28.5–32.8, snout 8.1–10.9, eye 7.7–11.0, post-orbital (8.4) 8.9–10.9 (11.0–11.4), upper jaw (12.0) 13.2–15.7 (16.0–16.9), lower jaw 13.8–16.2, pectoral fin (15.3–17.5) 18.0–21.5, pelvic fin 6.8–10.1, pre-dorsal (41.0–46.4) 47.3–51.6 (53.1), pre-pelvic (39.9) 45.6–54.3, pre-anal (53.5) 59.4–68.6 (73.7), anal base (29.6) 32.4–38.5.

Body very strongly compressed. Ventral profile extremely convex, dorsal profile slightly so. Head always much shorter than maximum body depth (by at least 2%). Upper jaw much longer than the snout, the maxilla reaching about one quarter to half into the eye through the vertical. A small toothed hypo-maxillary bone present, lying between the end of the pre-maxilla and middle of the maxilla. Eye very large, the diameter generally greater than the snout length. Lower jaw prominent, projecting upwards in front of snout. Fronto-parietal striae absent; two raised ridges on either side of head from occiput to snout. Dorsal fin base much nearer to snout than to the caudal base; pelvic fins small, lying just anterior of dorsal origin, much nearer to anal origin than to the pectoral base. Scales (from shoulder) with 5–6 vertical striae, the posterior complete. Posterior scale borders not crenulate, perforations absent.
COLOUR: *Fresh* (scales fallen), dorsal and dorso-lateral surfaces very light brown with an irridescent green tinge. Posterior borders of dorsal scale pockets black; mid-dorsal line black. Sides and belly silvery. Snout brown, speckled black. Lower jaw silvery, the tip brown and speckled black. Anterior rays of dorsal fin brownish, the first 3–4 rays speckled black. Caudal yellowish, rays streaked black or very dark brown; margins of fin dusky. Other fins colourless.

In alcohol, dorsal surfaces light green or brown, sides yellowish or white. Posterior borders of dorsal scale pockets brown. Snout and tip of lower jaw brown. First long ray of dorsal often deep black, fin dusky with dark margins. Caudal dusky, margins black. Rest colourless. A row of black spots along anal base in juveniles.
SIZE: 127 mm. S.L. (Zanzibar), 195 mm. in Natal.
DISTRIBUTION: Entire East African coast (recorded from Formosa Bay, Sabaki estaury, Mombasa, Shimoni, Pangani estuary and river, Ruvu estuary at Bagamoyo, Zanzibar and the Mafia Channel), apparently confined to waters of lowered salinity; in estuaries, mangrove area and occasionally in fresh waters of rivers (Pangani). The species occurred throughout the year but was seasonally abundant during the latter part of the southeast monsoon, also during and following the rainy seasons, when it occurred a little further offshore.

RANGE: East African coast south of Natal; Madagascar. Elsewhere, widely distributed in the Indian and Pacific oceans; India, Siam, East Indies, Philippines and Queensland. Apparently absent from the Red Sea, Gulf of Aden and adjacent regions where *Ilisha indica* (Swainson) is recorded (Whitehead, 1965b).
REMARKS: The genus *Pellona*, primarily composed of new-world species, is characterised by the possession of a small toothed hypo-maxillary bone lying between the end of the pre-maxilla and middle of the maxilla. In the closely allied Indo-Pacific genus *Ilisha* this bone is absent.

Family ENGRAULIDAE

ANCHOVIES

The genera *Stolephorus*, *Thrissina* and *Thryssa* occur in East African waters. The known range of the "anti-tropical" genus *Engraulis* has been extended into the tropics (Whitehead, 1964b), and it is known from Aldabra (Smith, 1955) and the Seychelles (Whitehead, *loc.cit.*), but not as yet from East Africa.

Key to the East African Genera

1. Abdominal scutes confined to pre-pelvic region . . . . . *STOLEPHORUS*
2. Post-pelvic scutes present:
   (i) No pre-pectoral scutes; pseudobranch exposed; anal rays 27–30 *THRISSINA*
   (ii) Pre-pectoral scutes present; pseudobranch not exposed; anal rays 32–47. . . . . *THRYSSA*

Genus STOLEPHORUS Lacépède, 1803

Stolephorus Lacépède, 1803 : 381 (Type: *Stolephorus commersonii* Lacépède).
Anchoviella: Fowler, 1941 : 696 (*non* Fowler, 1911).

Key to the East African Species

1. Anal origin under or behind last dorsal ray; muscular portion of isthmus short, not reaching the posterior border of the branchiostegal membrane; urohyal plate present:
   (i) Posterior tip of maxilla truncated, hardly projecting beyond 2nd supra-maxilla, not reaching to anterior border of the pre-operculum; mean head length 23% in S.L. . . . . . . *S. buccaneeri*
   (ii) Posterior tip of maxilla pointed, projecting well beyond 2nd supra-maxilla, reaching to posterior border of pre-operculum; mean head length 25% in S.L. . . . . *S. heterolobus*
2. Anal origin under posterior third of dorsal base; muscular portion of isthmus long, projecting forward beyond the posterior border of the branchiostegal membrane; urohyal plate absent:
   (i) Posterior tip of maxilla not projecting beyond the posterior border of the pre-operculum; mean body depth 18% in S.L. . *S. indicus*
   (ii) Posterior tip of maxilla projecting beyond the anterior border of operculum and reaching gill opening; mean body depth 21% in S.L. . . . . *S. commersonii*

The species of *Stolephorus* in East African waters may be considered in two groups, according to the structure of the isthmus and the position of the anal origin (see key above). In the first group, adults of the two species may be further distinguished in that in *S. buccaneeri* the urohyal plate is a small fleshy lobe lying just anterior to the tip of the muscular isthmus; in *S. heterolobus* it is a small shield-shaped bony plate lying in the same position. These structures are, however, not evident in juveniles of less than about 40 mm. S.L. In the second group it shoud be noted that in juveniles the muscular portion of the isthmus is relatively short and the urohyal (bone) is exposed, so that juveniles of the two groups cannot be distinguished on these characters. Body proportions and meristic characters of these species are compared in Tables 8 and 9.

STOLEPHORUS BUCCANEERI Strasburg

Stolephorus buccaneeri Strasburg, 1960 : 396, fig. 2 (Holotype; Type locality: Hawaii); Whitehead, 1965b : 268 (Red Sea, Persian Gulf, "Arabia"); Losse, 1966b : 176 (East Africa; Mombasa).
STANDARD COMMON NAME: Round head anchovy; Strasburg (1960) suggested this name for the species to distinguish it from the "nehu" *S. purpureus* Fowler, in which the head is rather more elongate.
VERNACULAR NAMES: *Dagaa uronda* (Zanzibar), *Kumbu* (Kenya)).

TABLE 8

A comparison of proportional measurements and meristic characters of *Stolephorus heterolobus* and *Stolephorus buccaneeri*

	Stolephorus heterolobus (48 fishes)	*Stolephorus buccaneeri* (19 fishes)
Standard length	37.0–80.0 mm.	41.2–85.4 mm.
In % of S.L.	*mean*	*mean*
Body depth	15.51	16.74
Head length	25.36	23.34
Snout length	5.62	5.09
Eye diameter	6.20	5.78
Post-orbital distance	12.33	11.16
Upper jaw length	18.17	14.00
Lower jaw length	15.57	15.16
Pectoral fin length	13.03	13.21
Pelvic fin length	9.13	8.51
Pre-dorsal distance	53.65	51.52
Pre-pelvic distance	44.58	45.14
Pre-anal distance	63.61	65.07
Anal base, length	17.27	14.82
Muscular portion of isthmus, length	8.73	10.22
Dorsal rays: simple	ii	ii
branched	11–12 (13)	(11) 12
Anal rays: simple	ii–iii	ii (iii)
branched	15–16 (17)	13–15
Abdominal scutes	4–6	(3) 4–6
Gillrakers	(19) 21–24+25–28	19–20+24–30

DESCRIPTION: Based on one fish, 51.6 mm. standard length, from Formosa Bay; two, 41.2–50.9 mm., from Mombasa; eleven, 48.9–85.4 mm., from the Zanzibar Channel and five, 71.4–78.6 mm., from the Mafia Channel.

Dorsal ii (11) 12, pectoral i (12–13) 14 (15), pelvic i 6, anal ii (iii) 13–15, total 15–17. Abdominal scutes needle-like, (3) 4-6 pre-pelvic only. Gillrakers 19–20+24–30, total 43–51 on 1st gill arch. Branchiostegal rays 12. Scales caducous, about 37–40 (pockets) in lateral series.

Depth 16.0–17.5, head 22.2–25.3, snout 4.6–5.6, eye 5.3–6.6, post-orbital 10.3–12.3, upper jaw 13.0–15.3, lower jaw 14.2–16.8, muscular portion of isthmus 8.8–11.8, pectoral fin 11.8–15.1, pelvic fin (7.4) 7.8–9.3 (10.2), pre-dorsal 50.0–53.7, pre-pelvic (39.9) 43.6–47.3, pre-nal 61.6–68.4, anal base 13.5–16.8. (The mean of these values are shown in Table 8).

Snout rounded at tip, shorter than eye diameter. Tip of lower jaw reaches well in front of the eye, about halfway to snout tip. Inter-orbital flat with a prominent median ridge. Maxilla short, posterior tip truncated, hardly projecting beyond 2nd supra-maxilla, not reaching anterior border of pre-operculum or lower jaw articulation. Muscular portion of isthmus short, the anterior tip not projecting forward to posterior borders of the branchiostegal membrane. Urohyal exposed, with two small fleshy lobes lying on vertral side of urohyal just anterior to muscular tip of isthmus; lobes well developed and visible with the naked eye in fishes of 47 mm. S.L. and above, poorly developed at 39 mm. and not seen in post-larvae of 34 mm. or less. Pseudobranch exposed. Anal origin set just behind dorsal base. Dorsal origin about equidistant from the snout and the caudal base, or slightly nearer snout. Pelvic origin in front of dorsal, about equidistant from pectoral and anal origins, or slightly nearer anal fin.

COLOUR: *In alcohol*, 47.5–85.4 mm. S.L., body whiteish to very light brown with a prominent silvery lateral band (dark in some specimens) from operculum to caudal base, broadest under dorsal base, as wide as eye diameter, bordered dorsally by a thick blue-black line (in some specimens above 51 mm. S.L.). Scale pockets above silver band with dark posterior borders. Sides of head, operculum, branchiostegal membranes, lower jaw and muscular portion of isthmus silvery. Occiput dark. Snout

dusky. Dorsal and anal fin bases with black spots, dorsal and caudal powdered black. Other fins colourless.
SIZE: 85.4 mm. S.L. (Zanzibar Channel).
DISTRIBUTION: Probably entire East African coast (recorded from Formosa Bay, Mombasa, Zanzibar Channel and Mafia Channel), in the shallow waters within the 30 fathom contour, in bays, harbours and lagoons. At times found together with *Stolephorus heterolobus* juveniles (Mombasa) but it is a northeast monsoon species rather less abundant than *S. heterolobus* which occurred throughout the year.
RANGE: Eastern coast of Africa; Red Sea, East African coast, Durban. Elsewhere, Persian Gulf, "Arabia" and Hawaii (Whitehead).

STOLEPHORUS HETEROLOBUS (Rüppell)

Engraulis heteroloba Rüppell, 1837 : 79, pl. 21, fig. 4 (Type locality: Massaua).
Stolephorus heterolobus: Whitehead, 1965b : 266, fig. 4a (isthmus) (Red Sea, Gulf of Aden); Losse, 1966a : 89 (Zanzibar); *Idem*, 1966b : 176 (East Africa; Dar-es-Salaam, Zanzibar, Mombasa, Malindi); *Idem*, 1966c : 51 (Zanzibar Channel).
STANDARD COMMON NAME: Long-head anchovy.
VERNACULAR NAMES: *Dagaa uronda* (Zanzibar), *Kumbu* (Mombasa).
DESCRIPTION: Based on forty-five fishes, 37.0–80.0 mm. standard length, from the Zanzibar Channel and four, 47.1–52.4 mm., from Mombasa.

Dorsal ii* 11–12 (13), pectoral i 11–13, pelvic i 6, anal ii–iii 15–16 (17). Abdominal scutes needle-like, 4–6 pre-pelvic only. Gillrakers (19) 21–24+25–28 on 1st gill arch. Branchiostegal rays 11–13. Scales caducous, about 39–42 (pockets) in lateral series.

Depth 13.9–18.1 (increasing with length of fish), head 23.8–27.1, snout 4.8–6.3, eye 5.1–6.9, post-orbital 10.4–14.1, upper jaw 16.5–20.0, extension of maxilla beyond 2nd supra-maxilla 1.7–2.7 (9 fishes), lower jaw 13.3–17.5, pectoral fin 11.1–14.4, pelvic fin 7.9–10.4, pre-dorsal 41.7–46.2, pre-pelvic 41.7–46.4, pre-anal 61.1–65.5, anal base 14.1–18.9 (19.8), muscular portion of isthmus 8.3–10.0 (22 fishes). (The mean of these values are shown in Table 8.)

Snout pointed at tip, slightly shorter than, or about equal to eye diameter. Tip of lower jaw almost reaches front of eye. Inter-orbital convex with a prominet central ridge. Maxilla moderately long, posterior tip pointed and projecting considerably beyond the 2nd supra-maxilla, reaching anterior border of operculum and just beyond lower jaw articulation. Muscular portion of isthmus short, the anterior tip not projecting forward to the hind border of the branchiostegal membrane. Urohyal exposed, with a flat bony, shield-shaped, ventral plate lying just anterior to the tip of the muscular portion of isthmus; plate well developed and visible with the naked eye in adults above 60 mm., poorly developed at 40 mm. and not seen in post-larvae of 37 mm. or less. Pseudobranch exposed. Anal origin beneath last dorsal ray or, rarely, slightly behind dorsal base. Dorsal origin nearer to snout than to the caudal base. Pelvic origin anterior to vertical from dorsal origin, much nearer to snout than to the caudal base.
COLOUR: *Fresh*, (scales fallen), body translucent, very light brown with a prominent silver lateral band from operculum to caudal base, bordered dorsally by a thin blue-black line. Lateral band widest under dorsal base, as wide or slightly wider than eye diameter. Sides of head, lower jaw, branchiostegal membranes, muscular portion of isthmus, urohyal and peritoneum silvery. Upper part of operculum with a greenish tinge and a patch of melanophores. Dorsal rays darkish, caudal faintly to prominently dusky, colourless in small specimens. A row of minute black spots along base of anal.

In alcohol, light brown to almost white. Lateral band silver, dark in some large specimens. Snout, dorsal and caudal dusky in some specimens.
SIZE: 88.0 mm. S. L. (Zanzibar Channel), specimen from stomach contents of *Euthynnus affinis*.
DISTRIBUTION: Entire East African coast (recorded from the Mafia Channel, Zanzibar Channel, Mombasa and Malindi), in shallow waters within the 100 fathom contour, in bays, harbours and lagoons. The species occurred throughout the year but was seasonally abundant in the surface waters close to the shore during the whole of the northeast monsoon and following the heavy rains in April/May.
RANGE: Eastern coast of Africa from the Red Sea to Madagascar (Nosy-Bé). Elsewhere, Australia, East Indies and the Philippines.

STOLEPHORUS INDICUS (Van Hasselt)

Plate 3c

Engraulis indicus Van Hasselt, 1823 : 329 (Type locality: Java).
Engraulis russellii: Jatzow & Lenz, 1899 : 525 (Zanzibar).
Anchoviella indica: Fowler, 1934a : 404, fig. 1 (Durban); *Idem*, 1934b : 412 (Durban); Smith, 1949-

*The first simple ray is minute and cannot be seen without dissection, hence I have excluded it from the count.

TABLE 9

A comparison of proportional measurements and meristic characters of *Stolephorus indicus* and *Stolephorus commersonii*.

	Stolephorus indicus (33 fishes)	*Stolephorus commersonii* (22 fishes)
Standard length	44.0–119.0 mm.	32.0–91.0 mm.
In % of S.L.	*mean*	*mean*
Body depth	17.82	21.46
Head length	23.54	24.46
Snout length	5.52	5.45
Eye diameter	5.96	6.45
Post-orbital distance	10.77	11.00
Upper jaw length	15.23	19.29
Lower jaw length	14.67	15.98
Pectoral fin length	12.68	15.56
Pelvic fin length	8.25	10.49
Pre-dorsal distance	54.52	53.87
Pre-pelvic distance	44.35	44.95
Pre-anal distance	63.29	63.54
Anal base, length	16.98	20.27
Extension of maxilla beyond 2nd supra-maxilla	1.90	4.55
Dorsal rays: simple	iii	iii
branched	(12) 13	12–13
Anal rays: simple	iii	iii
branched	16–18	(11)17–19
Abdominal scutes	(3)4–5	(3)4–7
Gillrakers	16–18+(22)23–25	17–19+21–26
Vertebrae	43 (6 fishes)	40–41 (8 fishes)

1965 : 94, fig. 118 (South Africa); Allfree & Bailey, 1952 : 74 (Kenya); Smith, 1955 : 307 (Aldabra); Fourmanoir, 1957 : 12 (Madagascar); Morrow, 1964 : 804 (Mkoani harbour, Pemba).
Amentum indicum: Fowler, 1956 : 74 (Indo-Pacific specimens).
Stolephorus indicus: Losse, 1954 : 12 (Zanzibar Channel); Whitehead 1965b : 270, fig. 4b (isthmus) (Red Sea); Losse, 1966a : 89 (Zanzibar); *Idem*, 1966b : 176 (East Africa; Dar-es-Salaam, Zanzibar, Mombasa, Malindi); *Idem*, 1966c : 51 (Zanzibar Channel).
STANDARD COMMON NAME: Indian anchovy.
VERNACULAR NAMES: *Dagaa uronda* (Zanzibar); *Kumbu* (Kenya coast), *Wali wa mpunga* (Mombasa).
DESCRIPTION: Based on three fishes, 92.0–96.0 mm. standard length, from Dar-es-Salaam; seventeen, 44.0–119.0 mm., from Zanzibar, and thirteen, 73.0–96.0 mm., from Mombasa.

Dorsal iii (12) 13, pectoral i 13–14, pelvic i 7, anal iii 16–18, abdominal scutes needle-like, (3) 4–5 pre-pelvic only. Gillrakers, 16–18+(22) 23–24 (25) on 1st gill arch. Scale caducous, about 39–40 (pockets) in lateral series. Vertebrae 43 (6 fishes, x-ray count).

Depth 15.5.–19.8, head 22.3–24.9, snout 4.6–6.5, eye 4.9–6.8, post-orbital 9.7–11.9, upper jaw 14.1–16.7, extension of maxilla beyond 2nd supra-maxilla (1.2) 1.5–2.8, lower jaw 14.1–15.6, pectoral fin 11.7–13.4 (14.8), pelvic fin 7.8–9.5 (10.3), pre-dorsal (52.5) 53.3–56.8, pre-pelvic 42.1–46.2, pre-anal 61.0–65.0, anal base 16.0–17.5 (18.2–18.6). (The means of these values are shown in Table 9.)

Body compressed, ventral profile slightly convex. Inter-orbital almost flat in large specimens, slightly convex in small specimens. Maxilla slender, moderately long, the posterior tip not reaching beyond the posterior pre-opercular border. Muscular portion of isthmus long, the anterior tip projecting forward beyond the hind margin of the branchiostegal membrane; no bony plate or fleshy lobes on urohyal. Pseudobranch exposed, equal to about snout in length. First dorsal ray nearer caudal base than to snout; anal origin beneath posterior third of dorsal base. Scales thin, those on shoulder with many (up to about 10) vertical striae; circuli very fine, vertically parallel.

Adipose tissue well developed, in some specimens obscuring eye, snout, sub-orbital and post-orbital parts of head.
COLOUR: *Fresh* (scales fallen), mainly translucent, body very light brown. Peritoneum whiteish. A prominent silver lateral band from operculum to caudal base, widest under dorsal base, narrower than the eye diameter. Side of head, operculum, branchiostegal membranes, isthmus and lower jaw mainly silvery. Iris silver with a greenish tinge. Base of anterior dorsal rays darkish. Caudal base yellowish, fin speckled black, dusky at margins. Pectoral fin with melanophores. A row of minute black spots along base of anal.

In alcohol, pink, light brown to white (due to formalin), silver band mostly faded to a light coloured band. Shoulder with a dark oval patch. Two dark patches on head. Caudal yellowish, dusky at margins. Other fins colourless.
SIZE: 119 mm. S.L. (Zanzibar Channel).
DISTRIBUTION: Entire East African coast (recorded from the Mafia Channel, Dar-es-es-Salaam, Zanzibar, Mombasa, Malindi and Formosa Bay), in the shallow waters within the 20 fathom contour; in bays, lagoons and harbours (Mombasa). Seasonally abundant during the northeast monsoon when it appeared close to the shore.
RANGE: Eastern coast of Africa from the Red Sea to Natal (Durban); Madagascar, Aldabra. Elsewhere, widespread in the Indian and Pacific Oceans; East Indies, Philippines, China, Formosa, Melanesia, Micronesia and Polynesia.

STOLEPHORUS COMMERSONII Lacépède

Plate 3d

Stolephorus commersonii Lacépède, 1803 : 381, 382, pl. 12, fig 1 (Mauritius; on Commerson); Losse 1966b : 177 (East Africa; Zanzibar, Ruvu estuary, Pangani estuary, Mombasa, Malindi).
Engraulis brownii: Günther, 1866 : 123 (Zanzibar).
Engraulis commersonianus: Günther 1868 : 388 (Zanzibar).
Anchoviella commersonii: Smith, 1949–1965 : 94, fig. 119 (Durban); Allfree & Bailey, 1952 : 47 (Kenya); Smith, 1958 : 131 (Inhaca, Mozambique).
STANDARD COMMON NAME: Commerson's anchovy.
VERNACULAR NAMES: *Dagaa uronda* (Zanzibar), *Kumbu* (Kenya), *Wali wa mpunga* (Mombasa district).
DESCRIPTION: Based on two fishes, 79.6–82.5 mm. standard length from Formosa Bay; nine, 75.0–90.6 mm., from Mombasa; one, 71.0 mm. from the Ruvu estuary (Bagamoyo); eight, 32.0–91.0 mm., from the Pangani estuary and one, 86.0 mm., from Zanzibar.

Dorsal iii 12–13, pectoral i 12–13, ventral i 6, anal iii (11) 17–19. Abdominal scutes needle-like, (3) 4–7, pre-pelvic only. Gillrakers lanceolate, 17–19 + 21–26, total 39–44 on 1st gill arch. Scales caducous, about 35–37 (pockets) in lateral series. Vertebrae 40–41 (8 fishes, x-ray count).

Depth 20.4–23.0 (18.5 at 32 mm.), head 23.5–26.3 (22.8 at 32 mm.), snout 4.8–6.5, eye 5.4–7.9, post-orbital 9.5–12.5, upper jaw 17.8–21.0, extension of maxilla beyond 2nd supra-maxilla 4.0–4.8 (19 fishes), lower jaw 14.9–16.4, pectoral fin 14.1–17.1, pelvic fin 9.4–11.6, pre-dorsal 51.8–54.5, pre-pelvic 43.3–47.9, pre-anal 60.8–66.8, anal base (9.6—abnormal specimen) 18.3–22.4. (The mean of these values are shown in Table 9.)

Body moderately compressed, ventral profile slightly convex from anal base to snout. Inter-orbital convex with a pronounced central ridge. Maxillary long and slender, the posterior tip reaching to posterior border of operculum and gill opening. Muscular portion of isthmus long, without bony plate or lobes on urohyal, projecting forward beyond the hind margin of the branchiostegal membrane. Pseudobranch exposed. First dorsal ray nearer to caudal base than to the snout. Anal origin beneath posterior third of dorsal base. Scales from shoulder with many (up to 10) vertical striae; anterior striae complete, rest interrupted. Circuli very fine, vertically parallel. Adipose tissue well developed on most specimens, covering greater part of the snout, post-orbital region and almost obscuring eyes.
COLOUR: *Fresh* (scales fallen), at 79–80 mm., S.L., body largely whiteish, peritoneum silvery. A prominent silver lateral band from operculum to caudal base, bordered above and below by a narrow yellowsih or olive line. Lateral band widest behind dorsal base, about half eye diameter in width. Sides of head, operculum, lower jaw and isthmus silvery. Parietal part of head irridescent greenish golden, occiput black. Supra-orbital part of head copper coloured with a bluish patch. Nape dark. Dorsal ray base with black spots; anal base with numerous minute black spots which are continued in a median ventral black line to caudal base. Caudal fin minutely powdered black, margins dark, base with a black dorsal and median streak. Orange reflections on caudal base and fin. Posterior borders of dorsal scale pockets brown to black.

In alcohol, pale brown to white, silver band more or less indistinct in most specimens. Dark patch on shoulder and on occiput. Caudal and dorsal yellowish, some melanophores on rays. Caudal tips dusky, rest colourless. Posterior borders of dorsal scale pockets dark.

At 32 mm., post-orbital part of head brownish; a row of small black spots along anal base, which lie between the ray bases. Caudal rays streaked brown-black, edges dusky.
SIZE: 91.0 mm., S.L. (Pangani estuary).

DISTRIBUTION: Entire East African coast (recorded from Zanzibar, Ruvu estuary at Bagamoyo, Pangani estuary, Port Reitz and Port Tudor at Mombasa, Malindi and Formosa Bay). Entirely confined to estuarine waters and mangrove lagoons, not found elsewhere in this area. The species was seasonally abundant during the northeast monsoon and also following the short and long rains.
RANGE: East African coast south to Durban; Madagascar, Mauritius. Elsewhere, widespread in the Indian and Pacific Oceans; India, Ceylon, East Indies, Philippines, China, Formosa, Korea and Polynesia. Whitehead (1965b) did not record this species from the Red Sea or adjacent areas.

Genus THRISSINA Jordan & Seal, 1925

Thrissina Jordan & Seal, 1925: 30 (Type: *Clupea baelama* Forsk.)
A monotypic Indo-Pacific genus.

THRISSINA BAELAMA (Forsk.)

Plate 4.a.

Clupea baelama Forsk. 1775: 72 (Type locality: Djedda, Red Sea).
Engraulis boelama (mis-spelt); Valenciennes, 1848: 35 (Seychelles, Mauritius); Günther, 1866: 123 (Zanzibar, Seychelles, Reunion); Playfair, 1867: 868 (Seychelles); Günther, 1868: 393 (Zanzibar); *Idem*, 1871: 671 (Zanzibar); Peters, 1876: 445 (Mauritius); Sauvage, 1891: 491, pl. 49, fig. 1 (Madagascar).
Thrissocles baelama: Baissac, 1951: 129 (Mauritius); Fowler, 1956: 72 (Indo-Pacific specimens); Fourmanoir, 1957: 11 (Madagascar); Smith, 1963: 8, pl. 4c (Seychelles).
Thrissina baelama: Whitehead, 1965b: 271 (Red Sea, Gulf of Aden); Losse, 1966b: 177 (East Africa: Dar-es-Salaam, Zanzibar, Mombasa, Malindi); *Idem*, 1966c: 51 (Zanzibar Channel).
STANDARD COMMON NAME: Short-jaw anchovy.
VERNACULAR NAMES: *Dagaa* (Zanzibar), *Simu* (Kenya), *Makarenge* (Mombasa).
DESCRIPTION: Based on seventeen fishes, 64.0–104.0 mm. standard length, from Zanzibar and six, 82.0–92.0 mm., from Dar-es-Salaam. Depth and meristics on four further fishes, 82.0–112.0 mm., from Dar-es-Salaam and two, 86.0–90.0 mm., from Mombasa.

Dorsal ii 11–12, pectoral i 11–13, pelvic i 7, anal iii 29–31. Abdominal scutes (4) 5–7 pre-pelvic + 9–10 post-pelvic, total 13–17, absent in front of pectoral fins. Gillrakers, 17–20 + 23–26, total 40–45 on 1st gill arch. Branchiostegal rays 12–13. Scales caducous, about 35–36 (pockets) in lateral series.

Depth 21.8–26.2, head 25.2–28.0, snout 4.8–5.9, eye 5.5–6.7, post-orbital 11.8–13.8, upper jaw 19.1–20.8, lower jaw (17.6) 18.8–20.6, pectoral fin 16.9–18.8, pelvic fin 12.3–14.5, pre-dorsal (47.3) 48.0–51.9, pre-pelvic 42.0–46.4, pre-anal 64.5–69.0, anal base 25.3–27.8, extension of maxilla beyond 2nd supra- maxilla 1.9–2.5 (17 fishes).

Body compressed, ventral profile slightly convex. Head rather longer than high. Inter-orbital convex. Snout blunt, tip rounded, considerably overhanging lower jaw. Maxilla short and slender, the posterior tip just surpassing angle of jaw. Gillrakers moderately flattened, blunt at tips, slightly longer than gill filaments, shorter than eye diameter. Pseudobranch exposed, about equal to snout or a little less in length. Dorsal origin nearer to snout than to the caudal base. Pelvic origin nearer to snout than to the caudal base. Pelvic origin nearer to pectoral base than to the anal origin. Anal origin behind dorsal base. Pre-dorsal spine poorly developed, not free.
COLOUR: *Fresh* (scales fallen), upper surfaces bluish-grey, sides silvery with an olive hue. No silver lateral band. A prominent orange-red humeral patch. Post-orbital part of head with orange patch and rays of dorsal fin orange-red, minutely speckled black. Tip of snout and caudal dusky with a reddish hue. Other fins colourless. Gillrakers and opercular cavity pink or grey.

In alcohol, dorsal surfaces brownish, flanks olive with orange hue. Patch of venulose tissue on shoulder with a few faint, dark, horizontal lines. Dorsal fin dusky at tips. Other fins colourless.
SIZE: 112 mm. S.L. (Dar-es-Salaam).
DISTRIBUTION: Entire East African coast (recorded from Dar-es-Salaam, Zanzibar, Mombasa, and Malindi), in bays, lagoons, harbours, estuaries (Pangani) and mangrove pools of varying salinity (Zanzibar); occasionally in the open sea. The species was seasonally abundant during the northeast monsoon.
RANGE: Eastern coast of Africa from the Red Sea to Madagascar; Seychelles, Mauritius and Reunion. Elsewhere, widespread in the Indian and Pacific Oceans; Philippines, Melanesia, Micronesia and Polynesia.

Genus THRYSSA Cuvier, 1829

Thryssa Cuvier, 1829: 323 (Type: *Clupea setirostris* Broussonet).
Thrissocles Jordan & Evermann, 1917: 98 (Type: *Clupea setirostris* Broussonet).

Key to the East African Species

1. Maxillae relatively short, extending slightly beyond bases of pectoral fins . . . . *T. vitrirostris*
2. Maxillae very long, extending beyond pelvic fins, often reaching anus *T. setirostris*

THRYSSA VITRIROSTRIS (Gilchrist & Thompson)

Plate 4b

Engraulis vitrirostris Gilchrist & Thompson, 1908–11: 201 (localities: Natal; inner harbour, Durban); Gilchrist, 1913: 64 (Natal).
Thrissocles vitirostris (mis-spelt): Fowler, 1925a: 413 (Durban, Natal); *Idem*, 1935: 366 (Natal).
Engraulis vitirostris (mis-spelt): Fowler, 1925b: 195 (Delagoa Bay).
Thryssa vitrirostris: Barnard, 1925 : 118, pl. 6, fig. 5 (East London, Delagoa Bay, Natal); *Idem*, 1927: 1017 (references); Whitehead, 1965b: 274 (Persian Gulf, Gulf of Oman); Losse, 1966b: 177 (East Africa; Zanzibar, Ruvu estuary, Pangani estuary, Mombasa, Malindi, Formosa Bay); *Idem*, 1966c: 51 (Zanzibar Channel).
Thrissocles malabaricus: Smith, 1949–1965: 95, pl. 5, fig. 121 (South Africa); *Idem*, 1955: 307 (Aldabra); *Idem*, 1958: 131 (Inhaca, Mozambique); Fourmanoir, 1961: 84 (Madagascar).
STANDARD COMMON NAME: Mustached anchovy.
VERNACULAR NAMES: None known.
DESCRIPTION: Based on one fish, 142.0 mm. standard length, from Dar-es-Salaam; nine, 35.0–140.6 mm., from the Pangani estuary; one, 119.0 mm., from Mombasa; six, 91.0–146.0 mm., from Malindi, and three, 79.0–102.7 mm., from Formosa Bay.

Dorsal I iii 11, pectoral i 11–12, pelvic i 7 (fin absent in 141 mm. specimen), anal iii-iv 35.38. Abdominal scutes, 18-19 pre-pelvic, 9–11 post-pelvic, total 27–29 (31 in 141 mm. specimen). Gillrakers 14–15+19–21 (12+21 on 2nd arch in 141 mm. specimen, first arch absent on both sides), total 33–35 on 1st gill arch. Branchiostegal rays 9–10. Scales caducous, about 39–42 (pockets) in lateral series.

Depth 24.0–30.6, head 24.0–28.6, snout 4.4–6.3, eye 5.7–7.0, post-orbital 10.8–13.8, upper jaw 27.6–31.0, extension of maxilla beyond 2nd supra-maxilla 9.7–13.5, lower jaw 17.0–20.0, pectoral fin 16.7–20.9, pelvic fin 8.0–9.9, pre-dorsal 49.4–53.9, pre-pelvic 39.2–44.3, pre-anal 55.6–64.5, anal base 33.0–37.3.

Body highly compressed, dorsal profile convex anterior to dorsal fin (a distinct nape in the larger specimens). Inter-orbital convex with a pronounced central ridge. Snout blunt, slightly compressed. Maxilla moderately slender, posterior tip surpassing pectoral base but not reaching tip of pectoral fin. Gillrakers flattened, slightly shorter than gill filaments. Spines on rakers of 1st gill arch with regular clumps of longer spines—not evident in juveniles. Pseudobranch not exposed. Lower jaw without steeply ascending coronoid. Dorsal origin about equidistant from snout and caudal base. Anal set behind last dorsal ray.
COLOUR: *Fresh* (scales fallen), dorsal surfaces brownish-olive, sides operculum and isthmus silvery. Top of head and snout tip brownish with numerous small melanophores. Shoulder venulose with melanophores forming horizontal lines—a black patch evident. Anterior rays of dorsal yellowish. Caudal yellowish with dark or almost black margins. Other fins colourless. Opercular cavity salmon pink, gillrakers sometimes faintly so.

In juveniles the body is very light brown. Sides of head and operculum silvery extending to anus as a triangular band, widest at shoulder. Dorsal brownish, anal dusky at tips; other fins colourless.

In alcohol, dorsal surfaces brown, sides silver or yellowish-white. First branched ray of dorsal dark, other fins colourless. Juveniles light brown, caudal margins dark. A row of black spots along anal base and a few dark spots on top of head.
SIZE: 146 mm. S.L. (Malindi), 149 mm. in Madagascar (specimen in EAMFRO collection) and 178 mm. in South Africa (Gilchrist & Thompson, 1908–11).
DISTRIBUTION: Entire East African coast (recorded from Dar-es-Salaam, Ruvu estuary, Zanzibar, Mombasa, Malindi, and Formosa Bay), in estuaries and lagoons; occasionally further out to sea during the rainy seasons when waters derived from the outflow of the major rivers extended further offshore.
RANGE: East African coast south to East London; Madagascar, Aldabra. Elsewhere, Persian Gulf and Gulf of Oman (Whitehead, 1965), coasts of India.

THRYSSA SETIROSTRIS (Broussonet)

Plate 4c

Clupea setirostris Broussonet, 1782: (no pagination), pl. 2 (Type locality: Society islands).
Engraulis setirostris: Gilchrist & Thompson, 1908–11: 267 (Natal); Gillchrist, 1913: 64 (Natal); Weber & de Beaufort 1913: 40, fig. 18 (Beira, East Africa).

Thryssa setirostris: Barnard, 1925: 119 (Natal, Portuguese East Africa); Whitehead, 1965b: 275 (Red Sea, Gulf of Aden); Losse, 1966b: 178 (East Africa; Ruvu estuary, Pangani estuary, Mombasa, Malindi, Formosa Bay).
Thrissocles setirostris: Fowler, 1934: 413 (Natal); Smith, 1949–1965: 95, pl. 5, fig. 122 (South Africa); *Idem*, 1955: 307 (Aldabra); Fowler, 1956: 71 (Indo-Pacific specimens); Fourmanoir, 1957: 11, fig. 18 (Madagascar); Smith, 1958: 131 (Inhaca, Mozambique).
STANDARD COMMON NAME: Long-jaw anchovy.
VERNACULAR NAMES: None known.
DESCRIPTION: Based on six fishes, 78.0–106.0 mm. standard length, from the Pangani estuary; one, 90.0 mm., from the Ruvu estuary at Bagamoyo and eleven, 116..0–129.7 mm., from Formosa Bay.

Dorsal I iii 10–12, pectoral i 12–13, pelvic i 6, anal iii–iv 32–34. Abdominal scutes (13) 16–19 pre-pelvic, 8–9 post-pelvic, total (22) 25–27, from gill opening to anus. Gillrakers, 5–6+10–12, total 15–18, on 1st gill arch. Branchiostegal rays 9–10. Scales caducous, about 38–41 (pockets) in lateral series.

Depth 24.4–28.1, head 21.6–23.1, snout 3.3–5.5, eye 5.0–6.1, post-orbital (9.8) 10.8–13.9, upper jaw 51.0 (? broken)–62.0, extension of maxilla beyond 2nd supra-maxilla 46.4–50.9, lower jaw 12.6–14.1, pectoral fin 19.1–22.6, pelvic fin 12.1–14.6, pre-dorsal 49.6–56.5, pre-pelvic 40.6–44.1, pre-anal 57.8–67.5, anal base 29.3–35.0.

Body highly compressed, dorsal and ventral profiles not markedly convex. Head about as high as long. Inter-orbital convex. Snout blunt and rounded, projecting only slightly beyond tip of lower jaw. Maxilla very slender and long, posterior tip surpassing tip of pelvic fin and often reaches anus. Lower jaw with a steeply ascending coronoid process. Pseudobranch not exposed. Gillrakers flattened, of moderate length, only slightly longer than fill filaments. Spines on gillrakers of first arch of even length. Dorsal origin about equidistant from the snout and the caudal base. Pelvic origin nearer to snout than to the caudal base. Anal origin just behind last dorsal ray. Scales large, almost circular with many (about 9) vertical striae; anterior striae interrupted, inter-digitating, posterior striae often complete. Very fine curved teeth on lower jaw and along entire length of maxilla except posterior extremity.

COLOUR: *In alcohol*, dorsal surfaces brownish; sides silvery, olive or orange in some specimens. Venulose patch on shoulder with melanophores forming black horizontal lines. Dorsal fin dusky, a little darker at tips. Caudal with dusky tips, other fins colourless.
SIZE: 129.7 mm. S.L. (Formosa Bay).
DISTRIBUTION: Entire East African coast (recorded from the Ruvu estuary, Pangani estuary and Formosa Bay), in estuaries and lagoons, rarely found out to sea.
RANGE: Eastern coast of Africa from the Red Sea to Natal; Madagascar, Aldabra. Elsewhere, widespread throughout the tropical Indo-Pacific, east to China, Queensland and Polynesia.

ACKNOWLEDGEMENTS

The author wishes to express his thanks to Mr. P. J. P. Whitehead, Fish section British Museum (Natural History) for many valuable discussions on clupeoid systematics, for reading the manuscript and making suggestions for its improvement.

Thanks are also expressed to the Director and staff of the East African Marine Fisheries Research Organization in Zanzibar for help and advice in the preparation of this paper.

LEGEND TO PLATES

Unless stated otherwise figures are of preserved specimens.

Plate 1

a *Elops machnata* (Forsk.), 169 mm. S.L., from Chukwani, Zanzibar.
b *Spratellomorpha bianalis* (Bertin), 38.8 mm. S.L., from Port Tudor, Mombasa.
c *Herklotsichthys punctatus* Form *B*, 77 and 99 mm. S.L., from Mombasa (fresh specimens).
d *Sardinella longiceps* (Val.), 131 mm. S.L., from Formosa Bay.

Plate 2

a *Sardinella albella* (Val.), 90 mm. S.L., from Mombasa.
b *Sardinella albella* (Val.), 110.6–123.2 mm. S.L., deep-bodied mature females from Port Tudor, Mombasa.
c *Sardinella gibbosa* (Blkr.), 136 mm. S.L., from Formosa Bay.

Plate 3

a *Sardinella sirm* (Walb.), 158 mm. S.L., from the Kenya coast.
b *Hilsa kelee* (Cuv.), 171 mm. S.L., from Port Tudor, Mombasa (fresh specimen).
c *Stolephorus indicus* (Van Hass.), 94 mm. S.L., from Port Tudor, Mombasa.
d *Stolephorus commersonii* Lac., 83 mm. S.L., from Mombasa.

Plate 4

a *Thrissina baelama* (Forsk.), 101 mm. S.L., from Port Tudor, Mombasa.
b *Thryssa vitrirostris* (Gilchr. & Thomp.), 124 mm. S.L., from Formosa Bay.
c *Thryssa setirostris* (Brouss.), 128 mm. S.L., from Formosa Bay.

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(*Received February 1968*)

NOTES ON BIRDS OBSERVED IN THE VICINITY OF TABORA, TANZANIA WITH SPECIAL REFERENCE TO BREEDING DATA

by

J. F. Reynolds

Mkwawa High School, Private Bag, Iringa, Tanzania

SUMMARY

1. A defined status is allocated to 297 avian species recorded within a 20 mile radius of the town of Tabora in Tanzania.
2. General descriptions are given of the areas in which the observations were made.
3. Data on the breeding seasons ("corrected" to months in which eggs have been found) and, in some cases, habits of 98 species are given.
4. The extent to which the data conform with Moreau's generalisations is briefly discussed.

INTRODUCTION

Apart from two periods of home leave (December and January 1961/1962; May to September 1964) and shorter periods of local leave when I visited other parts of East Africa, I was resident in Tabora, Tanzania, where I was teaching Biology at Tabora Boys' School, from early October 1959 until early December 1966. This paper summarizes most of the observations that I made on birds during this time.

All the birds that I have recorded personally within a twenty mile radius of Tabora are given in the annotated list that follows. Records for Sanderling and Terek Sandpiper additional to those published previously (Reynolds 1965a) are given. I have given each species a status defined as follows:

R+	Considered to be resident. Definite breeding records.
R	Considered to be resident. Presumed, but not proved, to breed.
B	Breeds, but uncertain whether resident throughout the year.
B?	Probably breeds, but uncertain whether resident throughout the year.
BM	Breeds, but absent for part of the year.
B?M	Probably breeds, but absent for part of the year.
OB	Breeds, but species uncommon in the area.
F	Frequently seen, with no clear cut seasonal peaks. Includes some species which probably breed but for which there is insufficient evidence to warrant this assumption.
M	Passage migrants and non-breeding visitors.
OM	Migrants which appear to be uncommon.
O	Occasional or accidental visitors.
??	Status not clear. Includes species that are seldom seen but are probably resident breeding species.

No status is given for species not seen around Tabora but recorded from either the Wembere or the Ugalla River Game Reserve although breeding records from these areas are included in the analysis of breeding data.

The numbers and most of the English names follow Mackworth-Praed and Grant (1955, 1957) as do scientific names except as follows: Purple Heron is placed in *Ardea* as in Williams (1963), Bock's (1958) classification of the larger plovers is used, and the Yellow Wagtails (695–701) are treated as a single species as in Williams (1963).

The list is in no sense a final check-list of Tabora birds as I have not attempted to amplify it from the, mostly, unpublished records of others who have studied birds in the area. Thus, for example, the Narina Trogon, *Apaloderma narina* (Stephens) and the Rosy-breasted Longclaw, *Macronyx ameliae* de Tarragon, were both collected by Mr. I. H. Dillingham (*in litt.*). I do not think, however, that I can have missed many resident birds in the areas which I visited regularly although there may well be small local patches of habitat suitable for species that I did not see; one such likely area is where the Igombe River runs into Igombe Dam.

A few birds not identified specifically are included in the list. In addition to these I fairly often saw a large species of *Cisticola* in very long grass areas that I was unable to identify, while at least one of the larger woodpeckers was frequently seen in the Simbo Forest Reserve, but never well enough for its identifying features to be noted. No birds were collected but my examination of skins in the collection of the Tabora Game Department aided me in the identification of several "difficult" species. A total of 297 species, of which 88 definitely bred, were recorded around Tabora; a further 41 species were recorded from the Wembere and Ugalla River Game Reserve.

BIAS IN THE OBSERVATIONS

The data recorded in this paper is biased in various ways though it is likely that, over the period concerned, the different sources of bias largely cancel each other out. The chief sources of bias are:

(1) Lack of experience at various times meant that behavioural clues indicating breeding were not always recognized.
(2) Most observations had to be made in the afternoon when, in general, display etc. are less conspicuous than in the early morning.
(3) As I gained experience I had a fairly good idea as to what species I could expect to find nesting in given places at a given time of year. More attention to these areas in their "off-seasons" might have added extra data.
(4) Primarily I was searching for nests in order to take photographs of the parent birds. This meant that frequently much time was spent in locating the territories and nests of particular species. When these had rather restricted habitat requirements my overall tally naturally fell.

GENERAL DESCRIPTION OF THE STUDY AREA

Breeding data given in this paper were obtained from three localities: (a) around Tabora, (b) in the Ugalla River Game Reserve, and (c) on part of the Wembere Steppe.

(a) Tabora

The town of Tabora is at an altitude of 4150 feet above sea level and is almost exactly 5°S. The recorded mean annual temperature is 22.8°C, a daily range of about 17°C being usual; frosts never occur although there are occasional hail storms.

There is a single rainy season from late November to early May with some tendency for a break in late December and January (not indicated by monthly rainfall figures). In general the rain falls in heavy thunderstorms that are often very local especially at the beginning and end of the rainy season. Table 1 shows the difference in the monthly figures as recorded at two stations (marked **a** and **b** on Table 1) in Tabora approximately 3 miles apart. The early storms of October and, more rarely, September are very local, making little, if any, extra water available for plant growth. Table 2 shows that there is considerable variation in the annual rainfall and that considerably higher than average rainfall occurred in 1960–1964.

The country around Tabora has been described as "steppe-like" though this term is hardly applicable to a region that is extensively wooded. One noteworthy feature of these deciduous woodlands, dominated by species of *Brachystegia*, is that not all the trees shed their leaves at the same time and that there is a very marked "flush" of new leaves that is quite apparent in August long before the onset of the rains. The general features of the *Brachystegia* (or *miombo*) woodlands have been described by Burt (1942) and Moreau (1966), but are not summarized here as most of my observations were made within a five mile radius of Tabora where the country is a mosaic of cultivation and regenerating woodland, interspersed with seasonally flooded areas most of which are used for rice growing. Rocky hills are a prominent feature of the landscape; the tops of many of these are bare

TABLE 1

MONTHLY RAINFALL FIGURES FOR TABORA 1959–1966

	1959		1960		1961		1962		1963		1964		1965		1966	
	mm.		mm.		mm.		mm.		mm.		mm.		mm.		mm.	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
J	112·2	N.R	186·1	164·4	55·0	164·8	186·0	163·6	229·9	211·5	207·1	189·7	8·1	45·0	13·7	112·3
F	129·5	N.R	293·0	199·6	226·0	110·8	93·5	94·5	184·9	190·7	250·9	163·9	235·9	211·5	12·3	124·8
M	128·7	N.R	159·7	137·4	118·5	112·3	252·2	180·3	135·0	189·0	244·0	232·9	246·8	174·2	163·8	182·1
A	13·0	N.R	203·1	187·2	68·0	83·8	121·3	135·4	114·0	109·7	135·6	147·3	95·2	87·4	79·8	63·0
M	13·2	N.R	Nil	Nil	Nil	Nil	51·1	58·4	31·9	27·4	1·9	3·3	Nil	Nil	Nil	Nil
J	Nil	N.R	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
J	Nil	N.R	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0·3	Nil	Nil	Nil	Nil	Nil
A	Nil	N.R	Nil	Nil	Nil	Nil	6·0	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1·0	Nil
S	13·0	0·8	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	3·1	21·0	25·7	Nil	Nil
O	39·0	6·9	178·7	N.R.	Nil	34·8	92·7	63·5	Nil	Nil	Nil	1·3	16·0	8·6	25·6	10·2
N	117·4	117·3	N.R	134·1	335·1	369·1	158·8	131·0	237·4	265·7	68·9	64·5	122·5	52·3	36·3	36·6
D	107·5	179·8	N.R	184·6	213·3	186·2	221·2	235·7	81·2	109·2	144·4	119·1	259·7	195·5	154·5	154·5
Total	675·5	701·4	1339·3	1186·0	1015·9	1061·8	1182·8	1062·4	1024·3	1101·2	1053·1	925·1	1007·2	800·2	487·0	683·3
Av. a & b	687·4		1262·7		1036·4		1122·6		1062·8		989·1		903·7		585·3	

TABLE 2
YEARLY RAINFALL FIGURES FOR TABORA 1950–1966

Year	*Rainfall* *mm.*	*in.*	*Source*
1950	888·4	34·18	Handbook of Tanganyika
1951	1297·0	51·08	
1952	756·0	29·76	
1953	743·9	29·29	
1954	726·8	28·61	
1955	736·7	29·01	
1956	804·4	31·67	
1957	872·2	34·34	Beekeeping Section Forest Division Tabora
1958	715·4	28·16	
1959	687·4	27·06	Table 1
1960	1262·7	49·73	
1961	1036·4	40·49	
1962	1122·6	44·22	
1963	1062·8	41·85	
1964	989·1	38·94	
1965	903·7	35·58	
1966	585·3	23·04	
Average over 48 years	875·0	34·45	Handbook of Tanganyika

apart from odd tussocks of grass and patches of *Vellozia*. Comparatively undisturbed *miombo* comes to within about 10 miles of the town along the track leading to Itigi.

Between the town and the aerodrome there was a comparatively large block of regenerating woodland that had been largely undisturbed for about 15 years. This extended from the west side of Aerodrome Road to the foot of a rocky hill that ran parallel to the road for about half a mile. On the other side of the road there were several sand quarries, a Forest Nursery and several acres fenced off from cattle and cultivation by the Bee-keeping Section of the Forest Division. This general area (Quarry Area) provided much of the breeding data for Tabora. In 1965 and 1966 cultivation started creeping into this area and many of its "best" parts had been destroyed when I left in 1966.

Three dams (= reservoirs) near to Tabora account for the good numbers of water birds and waders on the annotated list. Igombe Dam, the largest of the three, is some 12 miles from Tabora. Kazima Dam, 5 miles away, is smaller but is an easier place at which to watch birds. When I first saw Kazima Dam in October 1959 it was a pool about half an acre in extent surrounded by bare dry mud flats. It filled during the following rainy season and thereafter provided a large extent of shallow swamp in which thick patches of ambatch, *Aeschynomene elaphroxylon* (Guill & Perr.) Taub. and bulrushes developed. These provided a roosting place for Cattle Egrets drawn from a very large area around the town; flight lines were detected at least 10 miles from the dam. Long-tailed Cormorants from Igombe Dam also used to roost at Kazima Dam. Rufita Dam, much smaller than the other two and situated right on the outskirts of the town, was a good place for birds when I first arrived in Tabora, but it is now far too disturbed.

(b) The Ugalla River Game Reserve

The general ecology of this most attractive game reserve has been described by Thomas (1961). My visits to the Ugalla, with the exception of one trip in February 1965, were all between July and November, mostly at weekends. Apart from one White-breasted Tit's nest and one Green-winged Pytilia's nest all the nests found were of ground-nesting species on the dry flood plains. One small breeding colony of Open-billed Storks and Great White Egrets was known but was never visited while occupied, presumably between March and June.

(c) The Wembere Steppe

The parts of the Wembere that I visited consisted largely of Flood Plain Grasslands bordered by dense *Acacia* scrub on the eastern side. All this area, between Sakamaliwa and Lolanguru, is subject to seasonal flooding but the rains of 1959–1963 inundated vast areas of the plains, including isolated patches of *Acacia* growing on slightly higher ground normally more or less free from flooding. For several years extensive swamps persisted throughout the dry season but by 1965 most of these had dried out. In all years large open areas of dry mud flats and sandy plains formed during the dry season: my observations were centred on the plovers, coursers and pratincoles that bred on these.

I was never fortunate enough to see, during the height of the breeding season in March and April, the vast mixed colony of herons, Open-billed Storks, Wood-ibis, Sacred Ibis, Glossy Ibis and African Spoonbills discovered by Mr. B. W. Stronach. As he is describing this elsewhere (Stronach 1968) I have included no breeding data from this colony in this account. I saw no signs of the colony being used in March 1964; in 1965 I accompanied Mr. S. M. Moore-Gilbert in a flight over the whole length of the Wembere when we again failed to see any signs of breeding.

Annotated list of species recorded within a 20 mile radius of Tabora. Additional species recorded from the Wembere and the Ugalla River Game Reserve are listed separately at the end of this list.

Family Podicipidae (Grebes)		
2	Great Crested Grebe *Podiceps cristatus* Linnaeus	O
	My only record is of three at Rufita Dam on 23rd April, 1960.	
4	Little Grebe *Poliocephalus ruficollis* (Pallas)	R+
Family Phalacrocoracidae (Cormorants)		
27	Long-tailed Cormorant *Phalacrocorax africanus* (Gmelin)	R+
Family Anhingidae (Darters)		
28	Darter *Anhinga rufa* (Lacépède & Daudin)	R+
Family Pelecanidae (Pelicans)		
31	White Pelican *Pelecanus onocrotalus* Linnaeus	O
32	Pink-backed Pelican *Pelecanus rufescens* Gmelin	O
Family Ardeidae (Herons, Egrets and Bitterns)		
33	Grey Heron *Ardea cinerea* Linnaeus	O
34	Black-headed Heron *Ardea melanocephala* Vigors & Children	R
35	Goliath Heron *Ardea goliath* Cretzschmar	O
36	Purple Heron *Ardea purpurea* Linnaeus	O
37	Great White Egret *Casmerodius albus* (Linnaeus)	F
39	Black Heron *Melanophoyx ardesiaca* (Wagler)	O
40	Little Egret *Egretta garzetta* ((Linnaeus)	F
42	Cattle Egret *Bubulcus ibis* (Linnaeus)	M
43	Squacco Heron *Ardeola ralloides* (Scopoli)	F
45	Green-backed Heron *Butorides striatus* (Linneaus)	O
47	Rufous-bellied Heron *Erythrocnus rufiventris* (Sundevall)	F
	Williams (1963) states " . . . occurs very uncommonly in swamps in Uganda and Tanganyika . . .". I frequently flushed individuals from lush vegetation at the edge of Kazima Dam.	
48	Night Heron *Nycticorax nycticorax* (Linnaeus)	F
50	Little Bittern *Ixobrychus minutus* (Linnaeus)	??
51	Dwarf Bittern *Ardeirallus sturmii* (Wagler)	??
Family Scopidae (Hammerkop)		
53	Hammerkop *Scopus umbretta* (Gmelin)	R+
Family Ciconiidae (Storks)		
55	White Stork *Ciconia ciconia* (Linnaeus)	OM
56	Black Stork *Ciconia nigra* (Linnaeus)	OM
	My only record is of one at Igombe Dam on 20th March, 1960.	
58	Abdim's Stork *Sphenorynchus abdimii* (Lichtenstein)	M
59	Open-bill *Anastomus lamelligerus* Temminck	O
60	Saddle-bill *Ephippiorhynchus senegalensis* (Shaw)	O
61	Marabou *Leptoptilos crumeniferus* (Lesson)	F
62	Wood-ibis or Yellow-billed Stork *Ibis ibis* (Linnaeus)	F
Family Plataleidae (Ibises and Spoonbills)		
63	Sacred Ibis *Threskiornis aethiopicus* (Latham)	F
65	Hadada *Hagedashia hagedash* (Latham)	O
68	Glossy Ibis *Plegadis falcinellus* (Linnaeus)	F
70	African Spoonbill *Platalea alba* Scopoli	F

Family PHOENICOPTERIDAE (Flamingos)
72 Lesser Flamingo *Phoeniconaias minor* (Geoffroy) . . . . O

Family ANATIDAE (Ducks and Geese)
74 White-backed Duck *Thalassornis leuconotus* Eyton . . . . F
77 Southern Pochard *Aythya erythrophthalma* (Wied) . . . . O
88 Garganey *Anas querquedula* Linnaeus . . . . M
Earliest date: 23rd October, 1959; latest date: 18th March, 1960.
90 Hottentot Teal *Anas punctata* Burchell . . . . F
91 Red-bill *Anas erythrorhyncha* Gmelin . . . . F
94 White-faced Tree-duck *Dendrocygna viduata* (Linnaeus) . . . . . . O
95 Fulvous Tree-duck *Dendrocygna bicolor* (Vieillot) . . . . O
97 Pygmy Goose *Nettapus auritus* (Boddaert) . . . . F
98 Knob-billed Goose *Sarkidiornis melanotos* (Pennant) . . . . F
99 Egyptian Goose *Alopochen aegyptiacus* (Linnaeus) . . . . F
100 Spur-winged Goose *Plectropterus gambensis* (Linnaeus). . . . . . . F

Family SAGITTARIIDAE (Secretary Bird)
103 Secretary Bird *Sagittarius serpentarius* (Miller) . . . . O
My only records are of a single bird near Kazima Dam on 28th October and 1st November, 1959.

Family FALCONIDAE (Vultures, Eagles, Falcons and Hawks)
107 White-backed Vulture *Pseudogyps africanus* (Salvadori) . . . . . R
109 White-headed Vulture *Trigonoceps occipitalis* (Burchell) . . . . . . R+
111 Hooded Vulture *Necrosyrtes monachus* (Temminck) . . . . R
113 Lanner *Falco biarmicus* Temminck . . . . ??
115 Hobby *Falco subbuteo* Linnaeus . . . . OM
122 Red-necked Falcon *Falco chicquera* (Daudin) . . . . F
123 Kestrel *Falco tinnunculus* Linnaeus . . . . O
130 Cuckoo Falcon *Aviceda cuculoides* Swainson . . . . O
132 Kite *Milvus migrans* (Boddaert) . . . . R
133 Black-shouldered Kite *Elanus caeruleus* (Desfontaines) . . . . . . R+
139 Tawny Eagle *Aquila rapax* (Temminck) . . . . O
142 Wahlberg's Eagle *Aquila wahlbergi* Sundavall . . . . R
150 Lizard Buzzard *Kaupifalco monogrammicus* (Temminck) . . . . . . F
153 Brown Harrier-eagle *Circaetus cinereus* Vieillot . . . . O
My only record is of one near Igombe Dam on 12th June, 1960.
154 Black-chested Harrier-eagle *Circaetus pectoralis* Smith . . . . . . R+
159 Bateleur *Terathopius ecaudatus* (Daudin) . . . . F
160 Fish Eagle *Cuncuma vocifer* (Daudin) . . . . R+
163 Steppe Buzzard *Buteo vulpinus* (Gloger) . . . . OM
176 Shirkra *Accipter badius* (Gmelin) . . . . R
178 Gabar Goshawk *Micronisus gabar* (Daudin) . . . . R+
179/180 Chanting Goshawk *Melierax* sp . . . . F
183 Pallid Harrier *Circus macrourus* (Gmelin) . . . . M
184 Marsh Harrier *Circus aeruginosus* (Linnaeus) . . . . M
185 Harrier-hawk *Polyboroides typus* Smith . . . . O
My only record is of one on the outskirts of Tabora on 27th May, 1960.
186 Osprey *Pandion haliaetus* (Linnaeus) . . . . F

Family PHASIANIDAE (Game-birds)
191 Coqui Francolin *Francolinus coqui* (Smith) . . . . ??
198 Shelley's Francolin *Francolinus shelleyi* O. Grant . . . . ??
Birds seen had the characters of the bird described in Mackworth-Praed and Grant (1955) as *F. afer* Latham. The various East African forms of this bird are now regarded as races of *F. shelleyi* (Williams, 1967).
203 Hildebrandt's Francolin *Francolinus hilderbrandti* Cabanis . . . . . . R+
208 Red-necked Spurfowl *Pternistis cranchii* (Leach) . . . . R+
212 Harlequin Quail *Coturnix delegorguei* Delegorgue . . . . ??
215 Helmeted Guinea-fowl *Numida mitrata* Pallas . . . . F

Family RALLIDAE (Rails, Crakes and Moorhens)
222 Kaffir Rail *Rallus caerulescens* Gmelin . . . . ??
224 African Crake *Crecopsis egregia* (Peters) . . . . ??
225 Black Crake *Limnocorax flavirostra* (Swainson) . . . . R
228 Lesser Spotted Crake *Porzana pusilla* (Pallas) . . . . ??
237 Purple Gallinule *Porphyrio alba* (White) . . . . R
238 Allen's Gallinule *Porphyrula alleni* (Thomson) . . . . R

240	Lesser Moorhen *Gallinula angulata* Sundevall	R+
242	Red-knobbed Coot *Fulica cristata* Gmelin	O
Family Balearicidae (Cranes)		
245	South African Crowned Crane *Balearica regulorum* (Bennett)	O
Family Otididae (Bustards)		
258	Black-bellied Bustard *Lissotis melanogaster* (Rüppell)	??
Family Burhinidiae (Thicknees)		
262	Spotted Thicknee *Burhinus capensis* (Lichtenstein)	R+
Family Jacanidae (Jacanas)		
264	Jacana *Actophilornis africanus* (Gmelin)	R+
265	Smaller Jacana *Microparra capensis* (Smith)	R
Family Charadriidae (Plovers)		
266	Ringed Plover *Charadrius hiaticula* Linnaeus	M
271	Kittlitz's Sand-plover *Charadrius pecuarius* Temminck	BM
272	Three-banded Plover *Charadrius tricollaris* Vieillot	O
	My only record is of one at Kazima Dam on 13th October, 1959.	
275	Great Sand-plover *Charadrius leschenaultii* Lesson	O
277	Caspian Plover *Charadrius asiaticus* Pallas	O
281	Crowned Lapwing *Vanellus coronatus* (Boddaert)	O
282	Senegal Plover *Vanellus lugubris* Lesson	O
287	Blacksmith Plover *Vanellus armatus* (Burchell)	O
291	Wattled Plover *Vanellus senegallus* (Linnaeus)	M
293	Long-toed Lapwing *Vanellus crassirostris* (Hartlaub)	O
295	Avocet *Recurvirostra avosetta* Linnaeus	O
	My only record is of two at Kazima Dam on 23rd May, 1962.	
296	Black-winged Stilt *Himantopus himantopus* (Linnaeus)	F
Family Rostratulidae (Painted Snipe)		
297	Painted Snipe *Rostratula benghalensis* (Linnaeus)	F
Family Scolopacidae (Snipes)		
298/300	Snipe *Capella* sp (probably *gallinago*)	M
299	Great Snipe *Capella media* (Latham)	M
303	Curlew Sandpiper *Calidris testacea* (Pallas)	M
305	Little Stint *Calidris minuta* (Leisler)	M
307B	Broad-billed Sandpiper *Limicola falcinellus* (Pontopidan)	O
208	Sanderling *Crocethia alba* (Pallas)	O
	Additional records: one at Kazima Dam on 30th September and 3rd October, 1966.	
309	Ruff *Philomachus pugnax* (Linnaeus)	M
311	Terek Sandpiper *Xenus cinereus* (Güldenstädt)	O
	Additional record: one at Kazima Dam on 3rd October, 1966.	
312	Common Sandpiper *Tringa hypoleucos* Linnaeus	M
313	Green Sandpiper *Tringa ochropus* Linnaeus	OM
314	Wood Sandpiper *Tringa glareola* Linnaeus	M
315	Redshank *Tringa totanus* (Linnaeus)	OM
317	Marsh Sandpiper *Tringa stagnatilis* (Bechstein)	M
318	Greenshank *Tringa nebularia* (Gunnerus)	M
319	Black-tailed Godwit *Limosa limosa* (Linnaeus)	OM
321	Curlew *Numenius arquata* (Linnaeus)	OM
322	Whimbrel *Numenius phaeopus* (Linnaeus)	OM
Family Phalaropidae (Phalaropes)		
323	Red-necked Phalarope *Phalaropus lobatus* (Linnaeus)	O
Family Glareolidae (Coursers and Pratincoles)		
326	Temmink's Courser *Cursorius temminckii* Swainson	O
328	Heuglin's Courser *Hemerodromus cinctus* Heuglin	R+
329	Violet-tipped Courser *Rhinoptilus chalcopterus* (Temminck)	BM
330	Pratincole *Glareola pratincola* (Linnaeus)	F
Family Laridae (Gulls and Terns)		
342	Grey-headed Gull *Larus cirrocephalus* Vieillot	O
361	White-winged Black Tern *Chlidonias leucoptera* (Temminck)	M
362	Whiskered Tern *Chlidonias hybrida* (Pallas)	M
Family Turnicidae (Button-quails)		
365	Button-quail *Turnix sylvatica* (Desfontaine)	F

Family Columbidae (Pigeons)

379	Speckled Pigeon *Columba guinea* Linnaeus	R
386	Red-eyed Dove *Streptopelia semitorquata* (Rüppell)	R
388	Ring-necked Dove *Streptopelia capicola* (Sundevall)	R+
392	Laughing Dove *Stigmatopelia senegalensis* (Linnaeus)	R+
393	Namaqua Dove *Oena capensis* (Linnaeus)	OB
397	Emerald-spotted Wood-dove *Turtur chalcospilos* (Wagler)	R+
401	Green Pigeon *Treron australis* (Linnaeus)	F

Family Cuculidae (Cuckoos)

413	Great Spotted Cuckoo *Clamator glandarius* (Linnaeus)	B ?M
415	Black-and-White Cuckoo *Clamator jacobinus* (Boddaert)	B?
417	Didric Cuckoo *Chrysococcyx capius* (Boddaert)	B?
418	Klaas' Cuckoo *Chrysococcyx klass* (Stephens)	B?
423	White-browed Coucal *Centropus superciliosus* Hemprich & Ehrenberg	R+

Family Musophagidae (Turacos)

434	Violet-crested Turaco *Gallirex porphyreolophus* (Vigors)	R
441	Bare-faced Go-Away-Bird *Gymnoschizorhis personata* (Rüppell)	R+

Family Psittacidae (Parrots)

449	Brown Parrot *Poicephalus meyeri* (Cretzschmar)	R

Family Coraciidae (Rollers)

457	European Roller *Coracias garrulus* Linnaeus	M
460	Lilac-brested Roller *Coracias caudata* Linnaeus	F
461	Rufous-crowned Roller *Coracias naevia* Daudin	OM
463	Broad-billed Roller *Eurystomus glaucurus* (Müller)	F

Family Alcedinidae (Kingfishers)

465	Pied Kingfisher *Ceryle rudis* (Linnaeus)	R+
470	Malachite Kingfisher *Corythornis cristata* (Pallas)	R
471	Pigmy Kingfisher *Ispidina picta* (Boddaert)	R+
476	Brown-hooded Kingfisher *Halcyon albiventris* (Scopoli)	R
477	Grey-headed Kingfisher *Halcyon leucocephala* (Müller)	R+
479	Striped Kingfisher *Halcyon chelicuti* (Stanley)	??

Family Meropidae (Bee-eaters)

481	Bee-eater *Merops apiaster* Linnaeus	M
488	Little Bee-eater *Melittophagus pusillus* (Müller)	R+
496	Swallow-tailed Bee-eater *Dicrocercus hirundineus* (Lichtenstein)	??

Family Bucerotidae (Hornbills)

504	Grey Hornbill *Tockus nasutus* (Linnaeus)	F
505	Red-billed Hornbill *Tockus erythrorhynchus* (Temminck)	F
507	Von Der Decken's Hornbill *Tockus deckeni* (Cabanis)	F
509	Crowned Hornbill *Tockus alboterminatus* (Büttikorfer)	F

Family Upupidae (Hoopoes)

518	South African Hoopoe *Upupa africana* Bechstein	BM

Family Phoeniculidae (Wood-hoopoes and Scimitar-bills)

519	Green Wood-hoopoe *Phoeniculus purpureus* (Miller)	R+
526	Scimitar-bill *Rhinopomastus cyanomelas* (Vieillot)	R+

Family Strigidae (Owls)

528	Barn Owl *Tyto alba* (Scopoli)	R
534	Scops Owl *Otus scops* (Linnaeus)	??
536	White-faced Scops Owl *Otus leucotis* (Temminck)	??
543	Spotted Eagle-owl *Bubo africanus* (Temminck)	R+

Family Caprimulgidae (Nightjars)

551	Fiery-necked Nightjar *Caprimulgus fervidus* Sharpe	R+
554	Freckled Nightjar *Caprimulgus tristigma* Rüppell	R+
560	Gabon Nightjar *Caprimulgus fosii* Hartlaub	R+
564	Pennant-winged Nightjar *Semeiophorus vexillarius* Gould	O
	My only record is of one near Tabora on 28th December, 1959.	

Family Capitonidae (Barbets)

575	Black-collared Barbet *Lybius torquatus* (Dumont)	R+
584	Spotted-flanked Barbet *Tricholaema lacrymosum* Cabanis	R+
594	Red-fronted Tinker-bird *Pogoniulus pusillus* (Dumont)	M
600	Levaillant's Barbet *Trachyphonus vaillantii* Ranzani	O
	My only record is of one near Igombe Dam on 12th June, 1960.	

Family INDICATORIDAE (Honey-Guides)
605 Black-throated Honey-Guide *Indicator indicator* (Sparrman) . . . . . . R

Family PICIDAE (Woodpeckers)
623 Cardinal Woodpecker *Dendropicos fuscescens* (Vieillot). . . . . . . R

Family APODIDAE (Swifts)
643 Little Swift *Apus affinis* (Gray) . . . . R+
646 Palm Swift *Cypsiurus parvus* (Lichtenstein) . . . . R

Family EURYLAIMIDAE (Broadbills)
650 African Broadbill *Smithornis capensis* (Smith) . . . . B

Family ALAUDIDAE (Larks)
660 Flappet-lark *Mirafra rufocinnamomea* (Salvadori) . . . . . . R
682 Fischer's Sparrow-lark *Eremopterix leucopareia* (Fischer & Reichenow) . . R+

Family MOTACILLIDAE (Wagtails)
691 African Pied Wagtail *Motacilla aguimp* Dumont . . . . R+
695-701 Yellow Wagtail *Budytes flavus* (Linnaeus) . . . . M
706 Richard's Pipitt *Anthus novaesea landiae* Gmelin . . . .
708 Tree Pipit *Anthus trivialis* (Linnaeus) . . . . M
716 Yellow-throated Longclaw *Macronyx croceus* (Vieillot) . . . . . . B

Family TURDOIDIDAE (Babblers)
725 Arrow-marked Babbler *Turdoides jardinei* (Smith) . . . . R+
726 Black-lored Babbler *Turdoides melanops* (Hartlaub) . . . . R+

Family PYCNONOTIDAE (Bulbuls)
742 Dark-capped Bulbul *Pycnonotus tricolor* (Hartlaub) . . . . R+
769 Yellow-bellied Greenbul *Chlorocichla flaviventris* (Smith) . . . . . . R+

Family MUSCICAPIDAE (Flycatchers)
778 Spotted Flycatcher *Muscicapa striata* (Pallas) . . . . M
Earliest date: 6th October, 1959; latest date: 4th April, 1966.
779 Pied Flycatcher *Muscicapa hypoleuca* (Pallas) . . . . OM
My only record is of one in Tabora on 11th February, 1965.
793 Grey Flycatcher *Bradornis microrhynchus Reichenow* . . . . R+
801 Silver-bird *Empidornis semipartitus* (Rüppell) . . . . R+
817 Chin-spot Puff-back Flycatcher *Batis molitor* (Hahn & Küster) . . . . R+
832 Paradise Flycatcher *Tchitrea viridis* (Müller) . . . . B

Family TURDIDAE (Thrushes and allies)
839 Kurrichane Thrush *Turdus libonyanus* (Smith) . . . . R
850 Rock-thrush *Monticola saxatilis* (Linnaeus) . . . . OM
854 Wheatear *Oenanthe oenanthe* (Lianneus) . . . . M
868 Capped Wheatear *Oenanthe pileata* (Gmelin) . . . . B?M
871 Red-tailed Chat *Cercomela familiaris* (Stephens) . . . . R
876 Cliff-chat *Thamnolaea cinnamomeiventris* (Lafresnaye) . . . . . . R
883 Whinchat *Saxicola rubetra* (Linnaeus) . . . . OM
My only records are of single females on 16th November, 1961 and 25th November, 1964.
884 White-browed Robin-chat *Cossypha heuglini* Hartlaub . . . . . . R+
890 Red-capped Robin-chat *Cossypha natalensia* Smith . . . . F
910 Red-backed Scrub-robin *Erythropygia zambesiana* Sharpe . . . . . . R+
922 Sprosser *Luscinia luscinia* (Linnaeus) . . . . M

Family SYLVIIDAE (Warblers)
924 Whitethroat *Sylvia communis* Latham . . . . OM
925 Garden Warbler *Sylvia borin* (Boddaert) . . . . M
926 Blackcap *Sylvia atricapilla* (Linnaeus) . . . . OM
942 Great Reed Warbler *Acrocephalus arundinaceus* (Linnaeus) . . . . . . M
947 Sedge Warbler *Acrocephalus schoenobaenus* (Linnaeus) . . . . M
955/956 Swamp Warbler *Calamocichla* sp . . . . R+
959 Willow Warbler *Phylloscopus trochilus* (Linnaeus) . . . . M
Earliest date: 7th October, 1959; latest date: 19th March, 1962.
968 Grey Wren-warbler *Calamonastes simplex* (Cabanis) . . . . R+
979 Black-breasted Apalis *Apalis flavida* (Strickland) . . . . R+
997 Red-faced Crombec *Sylvietta whytii* Shelley. . . . . R+
1006 Green-cap Eremomela *Eremomela scotops* Sundevall . . . . ??
1011 Grey-backed Camaroptera *Camaroptera brevicaudata* ((Cretzschmar) . . . . R+
1016 Zitting Cisticola *Cisticola juncidis* (Rafinesque) . . . . B
1024 Rattling Cisticola *Cisticola chiniana* (A. Smith) . . . . B

1026 Trilling Cisticola *Cisticola woosnami* O. Grant . . . . R
1033 Winding Cisticola *Cisticola galactotes* (Temminck) . . . . R+
1040 Tabora Cisticola *Cisticola angusticauda* (Reichenow) . . . . R+
1045 Tawny-flanked Prinia *Prinia subflava* (Gmelin) . . . . R+

Family Hirundinidae (Swallows)
1054 Swallow *Hirundo rustica* Linnaeus . . . . OM
1058 Pearl-breasted Swallow *Hirundo dimidiata* Sundevall . . . . R+
1061 Wire-tailed Swallow *Hirundo smithii* Leach . . . . O
1063 Mosque Swallow *Hirundo senegalensis* Linnaeus . . . . R+
1065 Striped Swallow *Hirundo abyssinica* Guérin . . . . R+
1068 Sand Martin *Riparia riparia* (Linnaeus) . . . . OM
1073 African Rock Martin *Ptyonoprogne fuligula* (Lichtenstein) . . . . . F
1074 House Martin *Delichon urbica* (Linnaeus) . . . . OM

Family Campephagidae (Cuckoo-shrikes)
1081 Black Cuckoo-shrike *Campephaga sulphurata* (Lichtenstein) . . . . . . R
1085 White-breasted Cuckoo-shrike *Coracina pectoralis* (Jardine & Selby) . . . . F

Family Dicruridae (Drongos)
1088 Drongo *Dicrurus adsimilis* (Bechstein) . . . . R+

Family Prionopidae (Helmet-shrikes)
1090 Straight-crested Helmet-shrike *Prionops plumata* (Shaw) . . . . . . R+
1095 Retz's Red-billed Shrike *Sigmodus retzii* (Wahlberg) . . . . F
Around Tabora the only place where I saw this species was in the Simbo Forest Reserve, fifteen miles from Tabora on the Nzega road, where it appeared to be not uncommon.

Family Laniidae (Shrikes)
1097 White-crowned Shrike *Eurocephalus anguitimens* Smith . . . . ??
Although common on the Wembere this species is absent from the immediate vicinity of Tabora. I saw it in an *mbuga* between Itaga and Mambali, and in another on the way to Sikonge. Neither of these were visited regularly.
1098/1099 Brubru *Nilaus* sp . . . . ??
1103 Lesser Grey Shrike *Lanius minor* Gmelin . . . . M
1104 Fiscal *Lanius collaris* Linnaeus . . . . R
I saw this species in two places only—one near the hospital, the other near the Railway Training School—both of which appeared to support one pair each.
1112 Red-backed Shrike *Lanius collurio* Linnaeus . . . . M
Earliest date: 1st November, 1965; latest date: 17th April, 1966.
1118 Magpie-shrike *Urolestes melanoleucos* (Jardine) . . . . ??
Seen only on the periphery of the area in the same places as *Eurocephalus anguitimens*.
1121 Slate-coloured Boubou *Laniarius funebris* (Hartlaub) . . . . R+
1128 Black-backed Puff-back *Dryoscopus cubla* (Shaw) . . . . R
1133 Black-headed Bush-shrike *Tchagra senegala* (Linnaeus) . . . . . . R+
1134 Brown-headed Bush-shrike *Tchagra australis* (Smith) . . . . R+
1138 Sulphur-breasted Bush-shrike *Chlorophoneus sulfureopectus* (Lesson) . . . . R
1144 Grey-headed Bush-shrike *Malaconotus blanchoti* Stephens . . . . . . R+

Family Paridae (Tits)
1155 White-breasted Tit *Parus albiventris* Shelley . . . . R+
1160 African Penduline Tit *Anthoscopus caroli* (Sharpe) . . . . F

Family Oriolidae (Orioles)
1164 Golden Oriole *Oriolus oriolus* (Linnaeus) . . . . OM
1165 African Golden Oriole *Oriolus auratus* Vieillot . . . . ??
1167 Black-headed Oriole *Oriolus larvatus* Lichtenstein . . . . R+

Family Corvidae (Crows)
1172 Pied Crow *Corvus albus* Müller . . . . R+

Family Sturnidae (Starlings)
1182 Wattled Starling *Creatophora cinerea* (Menschen). . . . . M
1183 White-winged Babbling Starling *Neocichla gutturalis* (Bocage) . . . . . F
Seen only in *Brachystegia* woodland.
1184 Violet-backed Starling *Cinnyricinclus leucogaster* (Boddaert) . . . . . B?
A good deal of local movement certainly occurs but the species is probably resident in the area as a whole.
1188 Blue-eared Glossy Starling *Lamprocolius chalybaeus* (Hemprich & Ehrenberg) . F

Family Zosteropidae (White-eyes)
1219 Yellow White-eye *Zosterops senegalensis* Bonaparte . . . . M

Family NECTARINIIDAE (Sunbirds)
1233 Beautiful Sunbird *Nectarinia pulchella* (Linneaus). . . . . ??
1245 Mariqua Sunbird *Cinnyris mariquensis* Smith . . . . . R
1251 Variable Sunbird *Cinnyris venustus* (Shaw & Nodder) . . . . . R+
1263 Scarlet-chested Sunbird *Chalcomitra senegalensis* (Linnaeus) . . . . . R+
1271 Collared Sunbird *Anthreptes collaris* (Vieillot) . . . . . F

Family PLOCEIDAE (Weavers, Sparrows, Waxbills and allies)
1286 White-headed Buffalo-weaver *Dinemellia dinemelli* (Rüppell) . . . . . O
My only record is of a single bird near Kazima Dam on 27th February, 1960.
1291 Grey-headed Social-weaver *Pseudonigrita arnaudi* (Bonaparte) . . . . . R+
1300 Grey-headed Sparrow *Passer griseus* (Vieillot) . . . . . R+
1306 Chestnut Sparrow *Sorella eminibey* Hartlaub . . . . . M
1311 Speckle-fronted Weaver *Sporopipes frontalis* (Daudin) . . . . . R+
1313 Layard's Black-headed Weaver *Ploceus nigriceps* (Layard) . . . . . B
1319 Masked Weaver *Ploceus intermidius* Rüppell . . . . . B
1359 Red-headed Weaver *Anaplectes melanotis* (Lafresnaye) . . . . . R+
1360 Red-billed Quelea *Quelea quelea* (Linnaeus) . . . . . M
1362 Cardinal Quelea *Quelea cardinalis* (Hartlaub) . . . . . M
1365 Black-winged Red Bishop *Euplectes hordeacea* (Linnaeus) . . . . . R+
1372 Yellow-mantled Widow-bird *Coliuspasser macrourus* (Gmelin) . . . . . B?
1373 White-winged Widow-bird *Coliuspasser albonotatus* (Cassin) . . . . . B?
1379 Bronze Mannikin *Spermestes cucullatus* Swainson . . . . . R+
1402 Cut-throat *Amadina fasciata* (Gmelin) . . . . . F
1403 Quail-finch *Ortygospiza atricollis* (Vieillot) . . . . . ??
1410 Green-winged Pytilia *Pytilia melba* (Linnaeus) . . . . . R+
1413 Red-billed Fire-finch *Lagonosticta senegala* (Linnaeus) . . . . . R+
1420 Crimson-rumped Waxbill *Estrilda rhodopyga* Sundevall . . . . . F
1421 Zebra Waxbill *Estrilda subflava* (Vieillot) . . . . . ??
1427 Black-cheeked Waxbill *Estrilda erythronotos* (Vieillot) . . . . . R
1431 Red-cheeked Cordon-bleu *Uraeginthus benegalus* (Linnaeus) . . . . . R+
1435 Purple Indigo-bird *Hypochera ultramarina* (Gmelin) . . . . . B?
1441 Pin-tailed Whydah *Vidua macroura* (Pallas) . . . . . B?
1442 Steel-blue Whydah *Vidua hypocherina* Verreaux . . . . . B?
1444 Paradise Whydah *Steganura paradisaea* (Linnaeus) . . . . . B?

Family FRINGILLIDAE (Finches)
1448 Yellow-fronted Canary *Serinus mozambicus* (Müller) . . . . . R+
1461 Streaky Seed-eater *Serinus striolatus* (Rüppell) . . . . . O

Family EMBERIZIDAE (Buntings)
1469 Golden-breasted Bunting *Emberiza flaviventris* Stephen . . . . . R+
1476 Cinnamon-breasted Rock-bunting *Fringillaria tahapisi* A. Smith . . . . . R+

Additional Species recorded from the Ugalla River Game Reserve (U) and the Wembere (W):

Family STRUTHIONIDAE (Ostrich)
1 Ostrich *Strutio camelus* Linnaeus . . . . . WU
The species is uncommon at the Ugalla where my only record is of two near Senga on 15th November, 1964.

Family ARDEIDAE
38 Yellow-billed Egret *Mesophoyx intermedius* (Wagler) . . . . . W

Family FALCONIDAE
106 Ruppel's Griffon *Gyps rüppellii* (Brehm) . . . . . U
108 Lappet-faced Vulture *Torgos tracheliotus* (Forster) . . . . . WU
129 Pygmy Falcon *Poliohierax semitorquatus* (A. Smith) . . . . . W
146 Martial Eagle *Polemaëtus bellicosus* (Daudin) . . . . . W

Family PHASIANIDAE
195 Crested Francolin *Francolinus sephaena* (Smith) . . . . . W
209 Grey-breasted Spurfowl *Pternistis rufopictus* Reichenow . . . . . W

Family RALLIDAE
223 Corn Crake *Crex crex* (Linnaeus) . . . . . U

Family HELIORNITHIDAE (Finfoots)
243 Finfoot *Podica senegalensis* Hartlaub . . . . . U

Family OTIDIDAE
250 Kori Bustard *Ardeotis kori* (Burchell) . . . . . W

Family BURHINIDAE
263 Water Thicknee *Burhinus vermiculatus* (Cabanis) . . . . . U

Family CHARADRIIDAE
279 Grey Plover *Charadrius squatarola* (Linnaeus) . . . . W
286 Spur-winged Plover *Vanellus spinosus* (Linnaeus) . . . . . . W

Family SCOLOPACIDAE
310 Turnstone *Arenaria interpres* (Linnaeus) . . . . W

Family GLAREOLIDAE
327 Two-banded Courser *Hemerodromus africanus* (Temminck) . . . . . W

Family PTEROCLIDIDAE
369 Chestnut-bellied Sandgrouse *Pterocles exustus* Temminck & Langier . . . W
370 Black-faced Sandgrouse *Eremialector decoratus* (Cabanis) . . . . . W
372 Yellow-throated Sandgrouse *Eremialector gutturalis* (Smith) . . . . W

Family COLUMBIDAE
387 Mourning Dove *Streptopelia decipiens* (Finsch & Hartlaub) . . . . . W

Family CUCULIDAE
422 Senegal Coucal *Centropus senegalensis* (Linnaeus)* . . . . U

Family PSITTACIDAE
454 Fischer's Lovebird *Agapornis fischeri* Reichenow . . . . W

Family ALCEDINIDAE
466 Giant Kingfisher *Megaceryle maxima* (Pallas) . . . . U

Family MEROPIDAE
482 Madagascar Bee-eater *Merops superciliosus* Linnaeus. . . . . WU
Birds seen had the characters of *M.s. persicus* Pall., regarded as a separate species, *M. persicus*, by some authorities, e.g. Williams (1963).

Family BUCEROTIDAE
515 Ground Hornbill *Bucorvus leadbeateri* (Vigors) . . . . WU

Family PHOENICULIDAE
527 Northern Scimitar-bill *Rhinopomastus minor* (Rüppell) . . . . . . W

Family STRIGIDAE
544 Verreaux's Eagle-owl *Bubo lacteus* (Temminck) . . . . U

Family COLIIDAE
568 Blue-naped Mousebird *Colius macrourus* (Linnaeus) . . . . W

Family CAPITONIDAE
603 D'Arnaud's Barbet *Trachyphonus darnaudii* (Prévost & Des Murs) . . . W

Family APODIDAE
640 Alpine Swift *Apus melba* (Linnaeus) . . . . W

Family TURDIDAE
879 White-headed Black Chat *Thamnolaea arnotti* (Tristram) . . . . . . U
909 Spotted Morning Warbler *Cichladusa guttata* (Heuglin) . . . . . . W

Family SYLVIIDAE
946 African Reed Warbler *Acrocephalus baeticatus* (Vieillot) . . . . . . W
988 Karamoja Apalis *Apalis karamojae* (Van Someren) . . . . W

Family HIRUNDINIDAE
1066 Grey-rumped Swallow *Hirundo griseopyga* Sundevall . . . . W

Family STURNIDAE
1199 Ashy Starling *Cosmopsarus unicolor* Shelley . . . . W
1216 Superb Starling *Spreo superbus* (Rüppell) . . . . W
1218 Red-billed Oxpecker *Bulphagus erythorhynchus* (Stanley) . . . . . . WU

Family PLOCEIDAE
1285 Red-billed Buffalo-weaver *Bubalornis niger* Smith . . . . W
1290 Rufous-tailed Weaver *Histurgops ruficauda* Reichenow . . . . . . W
1432 Blue-capped Cordon-bleu *Uraeginthus cyanocephalus* (Richmond) . . . . W

BREEDING DATA

The months in which eggs have been recorded or deduced from records of young birds are shown in Table 3 which is summarized in Table 4. In general, signs of nest building have not been used to deduce the occurrence of eggs though this has been done for two species—Swamp Warbler and Drongo.

TABLE 3

MONTHS IN WHICH EGGS HAVE BEEN RECORDED OR DEDUCED

	Species	*Months in which eggs recorded or deduced*											
	(*a*) *Non-Passerines*	J	F	M	A	M	J	J	A	S	O	N	D
1	Little Grebe	...	...	+	+	...	...	...	...	...	...	...	...
2	Long-tailed Cormorant	...	+	+	...	...	...	...	...	...	...	...	...
3	Darter	...	+	+	...	...	...	...	...	...	...	...	...
4	White-headed Vulture	...	...	...	...	...	...	...	...	...	+	...	...
5	Black-shouldered Kite	...	...	...	...	+	...	...	...	...	...	...	...
6	Black-chested Harrier-eagle	...	...	...	...	...	...	...	...	...	+	...	...
7	Fish Eagle	...	...	...	...	...	+	+	...	...	...	...	...
8	Gabar Goshawk	...	...	...	...	...	...	...	...	+	...	...	...
9	Hildebrandt's Francolin	*	...	...	...	+	+	...	+	...	...	...	...
10	Red-necked Spurfowl	...	*	*	...	...	...	+	...	...	...	...	...
11	Lesser Moorhen	+	+	+	...	...	...	...	...	...	...	...	+
12	Spotted Thicknee	...	...	...	...	...	...	...	...	+	+	...	...
13	Jacana	...	...	+	+	+	...	...	...	+	+	...	...
14	Kittlitz's Sand-plover	...	...	*	...	+	+	+	+	+	...	...	...
14	Crowned Lapwing	...	...	...	...	+	+	+	+	+	...	...	...
16	Senegal Plover	...	...	...	...	...	...	...	...	+	+	+	...
17	Blacksmith Plover	...	...	...	...	...	+	+	...	...	...	...	...
18	Wattled Plover	...	...	...	...	...	...	...	+	+	+	+	...
19	Temminck's Courser	...	...	...	...	+	+	...	+	+	+	...	...
20	Two-banded Courser	...	...	...	...	+	+	+	+	+	+	...	...
21	Heuglin's Courser	...	...	...	...	+	+	+	+	+	+	...	...
22	Violet-tipped Courser	...	...	...	...	...	...	...	+	+	+	...	...
23	Pratincole	...	...	...	...	...	+	+	+	...	...	...	...
24	Black-faced Sandgrouse	...	...	...	...	...	+	...	...	...	...	...	...
25	Ring-necked Dove	...	...	+	+	...	...	...	+	...	...	...	...
26	Laughing Dove	+	+	+	*	+	+	+	+	...	...	...	...
27	Namaqua Dove	...	...	...	...	...	...	...	...	+	...	...	...
28	Emerald-spotted Wood-dove	+	...	+	+	+	...	...	...	...	...	...	...
29	White-browed Coucal	+	+	+	+	+	...	...	...	...	...	+	...
30	Bare-faced-Go-Away-Bird	...	...	...	...	...	+	...	+	...	...	...	...
31	Pied Kingfisher	...	...	+	+	+	...	...	...	...	...	...	...
32	Pigmy Kingfisher	...	...	...	...	...	...	...	...	.	...	+	...
33	Grey-headed Kingfisher	...	...	...	...	...	...	...	...	...	+	+	...
34	Little Bee-eater	...	...	...	...	...	...	...	...	...	+	+	...
35	African Hoopoe	...	...	...	...	...	...	...	...	+	...	...	...
36	Green Wood-hoopoe	...	...	...	...	*	...	...	...	...	+	...	...
37	Scimitar-bill	...	...	...	...	...	...	...	...	...	+	...	...
38	Spotted Eagle-owl	...	...	...	...	...	...	...	+	+	...	...	...
39	Fiery-necked Nightjar	...	...	...	...	...	...	...	...	...	+	...	...
40	Freckled Nightjar	...	...	...	...	...	...	...	...	+	...	...	...
41	Gabon Nightjar	...	...	...	...	...	...	...	...	+	...	...	...
42	Black-collared Barbet	...	...	...	...	?	...	...	...	...	+	...	...
43	Spotted-flanked Barbet	...	...	+	+	...	...	...	...	...	...	...	...
44	Little Swift	...	...	...	...	...	...	...	+	+	+	...	...

TABLE 3 (*Continued*)

	Species	*Months in which eggs recorded or deduced*											
	(*b*) *Passerines*	J	F	M	A	M	J	J	A	S	O	N	D
45	Broadbill	...	...	...	...	...	...	...	...	...	...	+	+
46	Fischer's Sparrow-lark	...	...	...	...	+	+	+	...	...	...	...	...
47	African Pied Wagtail	...	+	+	...	+	...	...	...	...	...	+	...
48	Richard's Pipit	...	...	...	...	...	...	...	...	+	...	...	...
49	Yellow-throated Longclaw	+	+	...	...	...	...	...	...	...	...	...	+
50	Arrow-marked Babbler	...	*	...	...	+	...	...	...	+	+	+	+
51	Black-lored Babbler	...	...	...	+	...	...	...	...	...	...	...	...
52	Dark-capped Bulbul	...	+	...	...	+	+	...	...	+	+	+	...
53	Yellow-bellied Greenbul	+	...	...	...	...	...	...	...	...	+	+	+
54	Grey Flycatcher	+	+	+	...	+	+	...	+	+	+	...	...
55	Silver-bird	+	...	...	...	...	...	...	...	...	...	+	...
56	Chin-spot Puff-back Flycatcher	...	...	...	...	...	...	...	...	...	+	+	+
57	Paradise Flycatcher	+	...	...	...	...	...	...	...	...	...	+	+
58	White-browed Robin-chat	...	...	...	...	...	...	...	...	...	...	+	+
59	Red-backed Scrub-robin	...	+	...	...	+	...	...	...	...	+	+	+
60	Swamp Warbler	...	...	...	+	...	...	...	...	...	...	...	...
61	Grey-wren Warbler	...	+	+	+	+	...	...	...	...	...	+	+
62	Black-breasted Apalis	+	...	...	+	...	...	...	...	...	...	...	+
63	Red-faced Crombec	...	...	...	...	+	...	...	...	...	...	...	...
64	Grey-backed Camaroptera	...	...	...	...	...	...	...	...	...	...	+	+
65	Zitting Cisticola	...	...	+	...	...	...	...	...	...	...	...	...
66	Rattling Cisticola	...	+	...	...	...	...	...	...	...	...	...	...
67	Winding Cisticola	+	+	+	+	...	...	...	...	...	...	...	...
68	Tabora Cisticola	...	+	...	...	...	...	...	...	...	...	...	...
69	Tawny-flanked Prinia	...	...	...	+	+	+	...	...	...	...	...	...
70	Pearl-breasted Swallow	...	+	+	+	...	...	+	+	+	...	...	...
71	Mosque Swallow	+	+	...	...	...	...	...	...	+	...	...	+
72	Striped Swallow	...	...	...	...	...	...	...	...	...	...	...	+
73	Drongo	...	...	...	...	...	...	...	...	...	...	+	...
74	Straight-crested Helmet-shrike	...	...	...	...	...	...	...	...	...	+	...	...
75	Slate-coloured Boubou	+	...	+	+	+	...	...	...	...	+	+	+
76	Black-headed Bush-shrike	...	+	...	+	+	...	...	...	...	+	+	+
77	Brown-headed Bush-shrike	+	+	...	+	...	...	...	...	...	+	+	+
78	Grey-headed Bush-shrike	...	...	...	...	...	...	...	...	...	+	+	...
79	White-breasted Tit	+	...	...	...	...	...	...	...	...	+	...	...
80	Black-headed Oriole	+	...	...	...	...	+	...	...	...	...	+	+
81	Pied Crow	...	...	...	...	...	...	...	...	...	+	+	...
82	Superb Starling	...	*	*	*	*	*	+	...	...	...	...	...
83	Variable Sunbird	+	...	+	+	+	+	...	+	...	...	...	...
84	Scarlet-chested Sunbird	...	...	...	...	+	...	...	...	...	...	...	...
85	Grey-headed Social Weaver	+	...	...	+	...	+	...	...	...	...	...	...
86	Grey-headed Sparrow	...	+	+	+	+	...	...	...	...	...	...	...
87	Speckle-fronted Weaver	...	+	...	...	+	+	+	+	...	...	...	...
88	Layard's Black-headed Weaver	*	+	+	*	...	...	...	...	...	...	...	*
89	Masked Weaver	...	...	...	+	...	...	...	...	...	...	...	...
90	Red-headed Weaver	...	...	...	...	+	...	...	...	+	...	+	+
91	Black-winged Red Bishop	...	+	+	+	+	...	...	...	...	...	...	...

TABLE 3 (*Continued*)

Species		*Months in which eggs recorded or deduced*											
(*b*) *Passerines* (*Continued*)		J	F	M	A	M	J	J	A	S	O	N	D
92	Bronze Mannikin	...	...	...	...	+	...	...	...	...	...	...	...
93	Green-winged Pytilia	+	+	+	+	+	...	...	+	...	+	...	...
94	Red-billed Fire-finch	+	+	...	...	...	...	...	...	...	...	...	...
95	Red-cheeked Cordon-bleu	+	+	+	+	+	...	...	...	...	...	...	...
96	Yellow-fronted Canary	...	+	...	...	+	+	...	...	...	...	...	...
97	Golden-breasted Bunting	+	+	+	...	...	...	...	...	...	+	+	+
98	Cinnamon-breasted Rock-bunting	...	...	...	+	+	...	+	...	...	...	...	...

+ personal records; * records from Thomas (1960)

TABLE 4

NUMBERS OF SPECIES BREEDING IN EACH MONTH

	WHOLE AREA					*AROUND TABORA*				
	Total	*Non-pass.*		*Pass.*		*Total*	*Non-pass.*		*Pass.*	
		No.	*%*	*No.*	*%*		*No.*	*%*	*No.*	*%*
J	24	5	21	19	79	24	5	21	19	79
F	30	6	20	24	80	29	6	21	23	79
M	28	13	46	15	54	27	13	48	14	52
A	28	8	29	20	71	27	8	30	19	70
M	36	13	37	23	63	32	10	31	22	69
J	22	12	55	10	45	15	6	40	9	60
J	14	9	54	5	36	9	5	56	4	44
A	19	14	74	5	26	14	9	64	5	36
S	24	17	71	7	29	18	12	67	6	33
O	31	16	52	15	48	27	12	44	15	56
N	27	6	22	21	78	25	4	16	21	84
D	21	1	5	20	95	21	1	5	20	95

The systematic notes that follow amplify the information given in Table 3, in particular giving full data for those species for which I have few records.

LONG-TAILED CORMORANT AND DARTER

In 1960 there was a mixed colony of these two species nesting in dead trees in the centre of Igombe Dam. I was not able to visit this colony in subsequent years as no boat was available.

WHITE-HEADED VULTURE

My sole record is of a bird apparently incubating on 25th October, 1966.

BLACK-SHOULDERED KITE

Coition followed by the carrying of sticks was seen on 15th May, 1961. The nest was later located in the District Commissioner's garden.

BLACK-CHESTED HARRIER-EAGLE

Two eyries were found, about 5 miles apart. Birds were seen apparently incubating in October 1961 and 1966.

FISH EAGLE

One apparently incubating in an eyrie at Igombe Dam in late June and early July 1965.

GABAR GOSHAWK

A nest found by Mr. I. H. Dillingham contained young in late September 1961.

HILDEBRANDT'S FRANCOLIN

Occurs on and around rocky hills. C/8 found on 16th May, 1965 hatched between 3rd and 4th June. A possibly incomplete C/4 found on 12th May, 1966 had been eaten by 14th May. Downy chicks were seen in late July 1966, and young with quills just appearing on 16th September, 1966.

RED-NECKED SPURFOWL

I failed to find any nests of this very common species. Mr. H. Saidi found what was probably a nest of this species in late April 1961.

LESSER MOORHEN

A nest containing one egg on 14th March, 1960 had the surrounding reed stems worked into a canopy over the nest. The bases of the stems had been brought together by pieces of rush "tied" in "half-granny" knots. This nest was flooded out.

SPOTTED THICKNEE

I found three nests: C/2 on 2nd October, 1960 hatched on 17th October; C/1 on 18th October, 1961; C/1 on 10th October, 1965. The latter nest was among tall tussocks of dead grass on the Wembere at least a mile from the nearest scrub.

JACANA

The latest date on which I saw eggs was 27th October, 1960 at Kazima Dam; at this time of year there is a considerable influx of non-breeding Jacanas.

On 5th June, 1962 a walking parent was seen carrying a chick tucked into the flank feathers under one wing from which the chick's legs dangled down and out.

C/3 and C/4 appear to be equally common.

KITTLITZ'S SAND-PLOVER

The margins of all three Tabora dams have been used for breeding when sufficiently sandy patches were present. It is very common on the Wembere where no nests or small young were seen during October, November and January visits. All nests found had C/2.

Observations from a hide indicated that eggs are covered whenever the bird leaves the nest and that covering is not confined to departures stimulated by the presence of potential enemies. On returning to the nest the bird makes gentle probing movements with its bill as if to locate the exact position of the eggs which are then uncovered by kicking movements with the breast pushed down onto the pile of sand covering the eggs.

CROWNED LAPWING

I found no nests around Tabora and consider it probable that it does not do so, though there are a few suitable areas. It is very common on the Wembere but considerably less so at the Ugalla where nesting appears to start later,

C/2 appears to be the most frequent clutch size,

SENEGAL PLOVER

All breeding records are from the Ugalla where C/3 appears to be commoner than C/2. Most clutches appear to be laid in October.

BLACKSMITH PLOVER

All my breeding records are from the Wembere where nests were usually sited within 20 yards of water.

On 10th July, 1962 I was photographing a bird at a nest with chipping eggs over which ants were swarming. One of the eggs had a large hole through which the ants were entering to attack the chick. The parent showed great agitation at the presence of the ants and eventually picked up the egg which the ants were entering, carried it to the water's edge and dropped it in the water. Normal incubation was then resumed.

WATTLED PLOVER

During the rainy season flocks of up to about 50 birds occur in and around paddy fields near Tabora.

All my breeding records are from the Ugalla where my latest record is of C/4 on 1st November, 1964. C/4 appears to be the usual clutch, though I have seen several broods of three chicks.

TEMMINCK'S COURSER

All breeding records are from the Wembere and Ugalla. Both sexes incubate.

TWO-BANDED COURSER

All records from the Wembere where the species is common. About forty nests, each with C/1, were found in all.

Keast and Marshall (1954) and Serventy and Marshall (1957) have produced evidence that the breeding of Australian desert birds is geared to rainfall and that such birds breed only when adequate rain falls. Winterbottom visited a district of the western karoo area of South Africa where a five year drought had ended a month earlier and another district where the drought had continued. He found Two-banded Coursers with eggs and/or young in the first locality but no sign of sexual activity in the birds of the second, though it is not stated whether this species was present in both areas. From these and similar observations Winterbottom and Rowan (1968) concluded that this courser is one of several arid country species whose breeding is stimulated by the onset of rain.

Maclean (1967) found that, in the Kalahari, breeding occurred throughout the year with no indications of its onset being stimulated by rain. My Wembere observations refer to the dry season as the area is virtually inaccessible during the rains. I cannot, therefore, say whether breeding takes place in well drained areas kept bare by heavy grazing. However, this possibility is supported by my finding a nest in the rainy season on 16th April, 1965 in Lake Manyara National Park.

Although many more observations are needed before any definite conclusions can be drawn, it would appear that Winterbottom's apparent correlation between rainfall and breeding might well be the result of insufficient sampling during dry conditions.

HEUGLIN'S COURSER

Common around Tabora and on the Wembere. A total of fifteen nests were found, all with C/2. In all nests the eggs were about three quarters buried in the substrate. No birds observed from a hide were seen attempting to turn the eggs during incubation which is carried out by both sexes.

At a nest found on 3rd September, 1966 the non-sitting bird could usually be found within 20 yards of the nest accompanied by two fledged young. These remained in the close vicinity of the nest until the eggs hatched on 25th September, after which I lost contact with the group.

VIOLET-TIPPED COURSER

This species appears to be migratory, arriving in the Tabora area in the second half of May and early June. At this time of year the birds can often be heard calling in flight over the town and, at night, may be seen in gardens and even the streets of the town.

My four breeding records are: At the Ugalla, C/3 found on 1st September, 1963 hatched on 20th September; C/2 found on 19th September, 1963 hatched on 23rd September; three young about $2\frac{1}{2}$ weeks old seen on 23rd October, 1964; at Tabora C/3 found on 9th October, 1966 hatched before 16th October.

The Ugalla nests were in large open glades though within 20 yards of patches of trees and bushes; the Tabora nest was in open secondary growth such as is often used by Heuglin's Courser.

PRANTINCOLE

All breeding records are from the Wembere.

BLACK-FACED SANDGROUSE

My sole record is of a pair with three fledged young on the Wembere on 12th July, 1961.

NAMAQUA DOVE

A nest with two well grown young at Kazima Dam on 9th October, 1963 is my only record.

BARE-FACED-GO-AWAY-BIRD

Two records only: C/2 on 13th August, 1960, and a nest with at least one small young on 20th June, 1965.

PIGMY KINGFISHER

An occupied nest, probably with eggs, at Tabora on 18th November, 1962. One seen carrying food on 28th November, 1966.

GREY-HEADED KINGFISHER

Nests with young birds 18th November, 1962 and 8th December, 1965. Nest with eggs 16th October, 1966; eggs hatched on 4th or 5th November.

LITTLE BEE-EATER

Eggs must be laid in late September and October as young are in the nests throughout November. I have no records that suggest egg laying before late September or after late October and I think in Tabora the species has a very restricted breeding season.

SOUTH AFRICAN HOOPOE

My only record is of a nest with large young in the hollow branch of an old mango tree in a Tabora garden on 13th October, 1966.

GREEN WOOD-HOOPOE

A nest with young on 5th November, 1959 is my only record.

SCIMITAR-BILL

A nest with large young found by Mr. J. A. S. Mackenzie-Grieve in November 1964 is my only record.

FIERY-NECKED NIGHTJAR

Two young, almost fledged on 20th November, 1966, were almost certainly of this species and constitute my only breeding record.

FRECKLED NIGHTJAR

C/2 laid on bare rock among burnt grass tussocks and *Vellozia* on a rocky hill was found on 16th September, 1966. These eggs hatched on the 24th and 25th September, but the chicks were attacked and killed by ants as soon as they emerged.

GABON NIGHTJAR

A male dissected on 2nd June, 1966 had very small testes. C/2 found on 10th September, 1966 hatched on 18th September.

BLACK-COLLARED BARBET

A pair were showing interest in a hole three feet above the ground on 24th April, 1966 but their behaviour did not conclusively indicate breeding. A pair probably had eggs on 25th October, 1966 as the presumed female stayed inside the hole while the mate vigorously chased two Black-throated Honey-guides that were showing great interest in the barbet's nest. The nesting stump was destroyed by fire.

BROADBILL

I saw this species only in the Quarry Area where it was remarkably elusive. A nest with C/2 was found on 27th November, 1964, and another being built on 16th November, 1966; this contained one egg on 30th November and C/2 on 2nd December, 1966.

BLACK-LORED BABBLER

My only record is of a nest found by Mr. I. H. Dillingham on 12th April, 1962 containing C/4, all of which had hatched by 18th April. Communal feeding of the young was observed at this nest (Reynolds 1965 b).

DARK-CAPPED BULBUL

Although the peak of breeding appears to be in late October and November I suspect that smaller numbers may nest throughout the year.

On 7th June, 1966 there was an occupied nest in a *Jacaranda* too high for inspection; presumably the same pair had built another high nest in a neighbouring tree that was occupied on 15th October, 1966.

Two nests found in November 1959 each contained a blue egg presumed to have been laid by a cuckoo (*Clamator* sp?); both were lost to predators.

SILVER-BIRD

This species is common on the Wembere; a few pairs are found in *mbugas* around Tabora where fledged young were seen on 4th February, 1965. On the Wembere a bird was believed to be incubating in the old nest of a Rufous-tailed Weaver on 8th November, 1964, and C/2 was found in another Rufous-tailed Weaver's nest on 7th January, 1965.

PARADISE FLYCATCHER

All nests in Tabora were found in the Quarry Area where building usually starts during the second week of November. Egg losses were very high but I failed to obtain evidence for either repeat nests or second broods.

On one occasion a female was observed singing near the nest.

CAPPED WHEATEAR

Territorial behaviour involving, apparently, paired birds can be observed on the open

country near the abattoir during May and June but I never obtained evidence that the birds were breeding.

WHITE-BROWED ROBIN-CHAT

This is rather an uncommon bird around Tabora though three or four pairs occur in the Quarry Area where all my nests were found. The first nest found contained C/2 on 17th November 1964. In 1965 a new nest was being built on the remains of this nest on 29th October and contained C/2 on 2nd November. In 1966 the nest in this territory was about two yards from the above site and contained C/2 on 10th November, hatching on 14th November. In another territory C/3 was found on 19th December, 1965.

SWAMP WARBLER

A pair were carrying nesting material into tall bulrushes at Kazima Dam on 7th April, 1963.

BLACK-BREASTED APALIS

A nest being built on 7th April, 1963 contained one egg on 13th April and C/2 on 21st April. Young were being fed in a nest about 20′ above the ground on 5th January, 1966. Another pair were building at this time but deserted before laying.

RED-FACED CROMBEC

My only record is of a nest found with C/2 on 13th May, 1962 by Mr. I. H. Dillingham.

GREY-BACKED CAMAROPTERA

The behaviour of the birds suggests that breeding is confined to the period November to February. Mr. Dillingham showed me a nest with C/2 in late November 1961; I found a nest with C/2 on 2nd January and another with two young on 5th January, 1966.

ZITTING CISTICOLA

Mr. Dillingham found a nest in March 1962. In 1966 I observed "zitting" from mid-January until late April but failed to find any nests.

RATTLING CISTICOLA

Nest with three young on 6th March, 1962. C/3 found on 17th Feburary, 1965; the young flew between the 4th and 5th of March.

TABORA CISTICOLA

Two nests found with young in the first week of March, one in 1965 and the other in 1966.

PEARL-BREASTED SWALLOW

The only place where I saw this species was in the immediate vicinity of Tabora Boys' School where there were two nesting sites. While it remains intact the same cup is used for successive broods; it is also used for roosting. The dry season broods are of interest, as Moreau (1964) implies that *Hirundo griseopyga* is the only species of swallow that nests in the dry season.

STRIPED SWALLOW

In Tabora, houses are not used for nesting. A few nests are built on the underside of large rocks supported by other boulders but the main nesting site is in drainage culverts passing under the roads.

DRONGO

This species is fairly common around Tabora but the only evidence that I have for breeding is a pair building on 5th November, 1959.

STRAIGHT-CRESTED HELMET-SHRIKE

The only nest found had C/2 on 8th October, 1966. The eggs hatched on 20th October but the young had been eaten by the 21st. Three birds were in attendance at this nest.

GREY-HEADED BUSH-SHRIKE

Only two nests found, both in a *Strychnos* about 9′ above the ground. The first was found on 21st November, 1964 with three small young and the second on 14th November, 1965 also with three small young.

SCARLET-CHESTED SUNBIRD

Additional records for this species that undoubtedly has a longer season than indicated in Table 3 were unfortunately lost.

SPECKLE-FRONTED WEAVER

In Mackworth-Praed and Grant (1955) the nest of this weaver is described as "... a roughly made sphere of grass with a side entrance usually suspended from the end of a bough ten to fifteen feet from the ground". I have seen many nests of this species and none of them has corresponded with this description. The nest is a rather coarse domed structure with a long entrance funnel at one side placed along, but not dependent from, a branch of, usually, an *Acacia*. The chamber is lined with feathers. Around Tabora most nests are between 6′ and 9′ above the ground.

BLACK-WINGED RED BISHOP

The onset of breeding is closely correlated with the availability of suitably long grass for nest sites which in turn is influenced by both the date when the rains start and the amount of rain in November, December and January.

C/3 is the commonest clutch size. In 1960 a nest was found in which the eggs were blue with fine black spots, and in 1963 one in which the eggs were white. The young are fed mostly by regurgitation but occasionally small insects (usually larvae) are brought.

GOLDEN-BREASTED BUNTING

C/2 appears to be about three times as common as C/3.

CINNAMON-BREASTED ROCK-BUNTING

During the breeding season the bird is confined to rocky hills. Song occurs from January to August though no nests have been found before April (however, I have not watched intensively in January, February and March so nesting may well start earlier). Most hills have only enough suitable habitat to support one or two pairs but one near Inara (about 9 miles from Tabora) had five or six pairs. Two nests were only about 20 yards apart. C/3 is the usual clutch; two C/4 have been found but in each case only three eggs hatched. Egg and nestling losses are high, snakes probably being the main predators though fires are also a hazard. Both parents feed the young by regurgitation: I never saw food being brought in the bill.

DISCUSSION

Moreau (1950), surveying the rather inadequate data then available on the breeding seasons of African birds, concluded that five breeding season patterns could be recognised:

1. the big raptors and scavengers, laying in the middle of the dry season;
2. some ground birds, such as nightjars, which tend to lay in the rains in areas where grass fires are not an extensive risk, but elsewhere to lay in the dry season after the grass fires are over;
3. the birds dependent on tall grass which necessarily wait until well after the rains have started, both for nesting sites and seeds;

4. the water birds which tend to nest when watery habitats have increased in extent as a result of the rains;
5. most other birds (nearly all dependent wholly or mainly on insects) which tend to nest early, beginning with the pre-rains flush of new foliage and insects.

In Moreau (1966) he concludes that the new data published since then in general support the generalisations quoted above. My opinions as to how my own data fit these generalisations are as follows:

Category 1

My data are far too scanty to warrant much discussion. The records for Black-shouldered Kite, Fish Eagle and Gabar Goshawk (though two of these hardly count as "big" raptors) conform but the Black-chested Harrier-eagle and White-headed Vulture appeared to lay towards the end of the dry season. Furthermore in Iringa (where I am at present working) I have found Kites and Tawny Eagles starting to nest at the very end of the dry season.

Category 2

I think that the individual requirements of ground nesting birds are so diverse that generalisation is apt to obscure too many ecological differences. "Ground nesting" is also a vaguer term than might at first be thought: most workers would agree that it would apply, for example, to both Heuglin's Courser and the Yellow-throated Long-claw but the siting of the latter's nest in clumps of grass makes it less vulnerable to flooding than the former's. As regards plovers, especially Senegal Plover and Crowned Lapwing, and coursers, especially the Violet-tipped and Temminck's, I would say that suitable conditions for nesting can be created as a result of burning, or of over-grazing, or a combination of both factors. I consider that this can be concluded from a comparison of conditions on the Wembere (heavily overgrazed) and the Ugalla (subject to fires from July onwards); Crowned Lapwings breed from May onwards on the Wembere while nests have only been found in August and September on the Ugalla.

Category 3

My experience with the Black-winged Red Bishop and the cisticolas, especially *galactotes* is in complete conformity with the generalisation.

Category 4

I consider this a rather unsatisfactory category on much the same grounds as Category 2: there are great differences in the nesting sites of water birds. My rather limited data for this group do, however, tend to conform.

Category 5

There is no doubt that a number of species start nesting well before the onset of the rains, though I think it equally true that the timing of many of these "early" nests is such that the first heavy storms tend to coincide either with the presence of young in the nest or with recently fledged young. Although the leaf flush is so obvious my (admittedly somewhat subjective) impression is that there is no marked flush of insects, or for that matter arthropods in general, until after at least three or four heavy down-pours. This is certainly true for beetles, termites, millipedes, centipedes and also mollusca.

As regards evidence for a widespread pre-rains start of nesting I would conclude that, in general, my data do not support the generalisation. This statement requires amplification as I have recorded 27 species with eggs in October (Table 4). Three of these—Heuglin's and Violet-tipped Courser and Spotted Thicknee—are dry season nesters hatching their eggs well before the start of the rains, while the bulk of the rest lay

at the end of the month so that young are likely to coincide with the November storms. The increase to 29 species in February is mainly due to conditions becoming suitable for Category 3 birds.

ACKNOWLEDGEMENTS

It is a pleasure to thank Messrs I. H. Dillingham, L. A. Haldane and B. W. Stronach for their assistance in problems of identification when I first arrived in Tabora. I should also like to thank the officers in charge of the Bee-keeping Section and the Water Development and Irrigation Department, Tabora for making their rainfall records available to me.

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(*Received 3rd January 1967*)

CURCULIONIDAE (WEEVILS) OF THE ALPINE ZONE OF MOUNT KENYA

(Results of the University College Nairobi Mount Kenya Expedition of March 1966—Publication 1)

I. Jabbal

(*Zoology Department, University College, Nairobi*)

R. Harmsen

*Presently at University of Toronto, Toronto, Ontario, Canada.

INTRODUCTION

In March 1966, a number of biologists of University College, Nairobi, under the leadership of Dr. Malcolm J. Coe, undertook a research expedition to the alpine zone of Mount Kenya. The main purpose of the expedition was to study the ecology of the relatively dry northern slopes of Mount Kenya which, from a biological standpoint, were virtually unknown. The Base Camp was erected at 12,500 ft. (3,800 m.) in the Kazita West Valley. Most work was carried out in the vicinity of the camp, but a number of collections were made up to the head of the valley (c. 14,000 ft.—4,300m).

The vegetation in this region is fairly typical of the lower alpine zone: consisting mainly of open tussock grassland and patches of *Carex monostachya* A. Rich. bog on drainage impeded soils. Collections were made in the following situations:

1. *Festuca abyssinica* St-Yves and *F. pilgeri* A. Rich. tussocks.
2. *Lobelia keniensis* R.E. Fr. & Th. Fr. jr. rosettes and inflorescences.
3. Open soil and rocky ground.

RESULTS

Occurrence and Distribution

Appendix 1 includes all the species of Curculionidae so far recorded from the moorland and alpine zones of Mount Kenya (9,000ft.—14,900ft. or 2,700m.—4,500m.). This information has been derived from our own collection and the one of the National Museum of Kenya as well as from a survey of the main relevant works in the literature: A. Hustache (1929) and S. Schenkling (1934).

Ecology

Only five species were found to be of some ecological importance either because of their abundance or as a result of a particular position in a food chain or microhabitat. Other species may well have such importance in other times of the year or in other microhabitats, as yet undiscovered. The ones of obvious ecological importance as discovered so far are:

1. *Parasystates elongatus* Hust.
2. *Cossonus frigidus* Hust.
3. *Seneciobius basirufus* Mshl.
4. *Amphitemetis sulcipennis* Mshl.
5. *Afrotroglorrhynchus* (*nivalis*?) Hust.

The following ecological data were collected for the above listed species:

1. *Parasystates elongatus* Mshl. (Plates 1–3)

A number of adults of this species were collected (from open soil in *Festuca* tussock areas) during day time when weather conditions allowed dispersal and mating activity (air temperature 12°C and direct solar radiation).

During a study of the *Festuca* tussock as an ecological microhabitat, mature and immature adults as well as larvae and pupae of this species were collected from *F. abyssinica* tussocks. The specimens were found in chambers produced by the larva in the region of the tussock just above the stem bases. The main matrix of this region consists of semi-decayed, dead *Festuca* leaves and is penetrated by the living stems of the grass. The beetle larva appears to feed on the lower portions of the live stems, but may derive some nutrition from the dead matter as well. Pupation takes place in the chambers and the adult emerges and matures there as well.

The amount of damage done by *Parasystates* to the *Festuca* tussocks is very limited because of the relative rarity of the species. It is, however, potentially a tussock killer because of its mode of feeding.

This species was mainly found in *F. abyssinica*, but appeared to be uncommon in *F. pilgeri;* whether this reflects a highly selective host specificity or a habitat preference is not known. Within the tussock, the placing of the chamber does reflect a very sensitive microhabitat selection. The chambers are never in the waterlogged region of the tussock below the stem-base and never in the dry upper region. The region in which the chambers are found provides maximum protection against drowning, fire, and predators. This extent of safety to the larvae and pupae makes this species potentially an "outbreak" species which, under certain conditions, could severely damage the *F. abyssinica* cover resulting in considerable changes in the ecomorphology of the alpine zone.

2. *Cossonus frigidus* Hust. (Plates 4–7)

The larvae and pupae of this species were found in very large numbers in the inside of the hollow, recently died, woody regions of the rachis of *Lobelia keniensis*. Here, they appeared to form a major factor in the disintegration of these structures. They were never encountered in living specimens of *Lobelia*, nor in the dead "leaf frills" below the living rosette; this, possibly, because of the more or less anoxic conditions of these habitats. The adults emerge in the dead rachis and must then undertake a period of dispersal and mating. No free moving specimens were collected, but a number of mature adults were found in *Lobelia* inflorescences. It seems probable that the adults are attracted to these inflorescences after dispersal and that they remain stationary here until the flowering period of the *Lobelia* ends and oviposition takes place.

This species obviously does not harm the standing vegetation in any way, and is, therefore, of no influence on the vegetation composition and succession of the alpine zone. The larvae are subject to predation by a number of predatory staphilinid larvae which also inhabit the dead *Lobelia* rachis. There is a further, and perhaps more severe, predation at the time of adult concentration on the *Lobelia* inflorescence by a number of insectivorous song birds. In particular the Hillchat (*Pinarochroa sordida earnesti* Sharpe) and the Scarlet Tufted Malachite Sunbird (*Nectarinia j. johnstoni* Shelley) were regularly observed feeding on the insects in the *Lobelia* inflorescence.

3. *Seneciobius basirufus* Mshl. (Plate 8)

Mature, adult specimens of this attractively coloured beetle were collected from tussock grassland and from among rocks on open, frost heaved soil. They appeared quite lethargic when the air temperature was low but as soon as it became warm they showed considerable activity. Some of them were caught walking, but no mating was observed. One specimen was collected at 14,000′ altitude in a completely moribund state under dead vegetable litter on a cold, cloudy morning (air temp. ± 3°C in shady areas).

Of this species, neither larvae nor pupae were encountered.

Because of its considerable size (16.5 mm.) and its local abundance, this species could form a significant percentage of the food of certain mammals or larger birds. Augur Buzzards (*Buteo rufofuscus augur* Rupp.) were often observed catching beetles and hundreds of beetle elytra were found in buzzard pellets; none of these, however, belonged to *S. basirufus*. It is possible that the species is poisonous or distasteful, a situation often found in brightly coloured, slow moving animals.

4. *Amphitemetus sulcipennis* Hust. (Plate 9)

The adults of this species were also collected from among rocks on open soil and from patches of vegetation mainly consisting of *Festuca* tussocks and *Alchemilla* cover. Considerable activity, including mating, was observed as soon as the weather became warm: i.e. air temperature 12°C and direct solar radiation. This beetle was quite common in certain areas and could constitute a major source of protein nutrition for larger birds and such mammals as shrews and insectivorous rodents (e.g. *Lophuromys*). No direct evidence of such predation is available, and Augur Buzzard pellets did not contain *Amphitemetus* elytra. This may be because of the excellent camouflage of these slow moving beetles. Another reason could be that the buzzards find it uneconomical to feed on these small beetles when there are a large number of rodents, shrews and larger beetles available. The beetle's "freezing" behaviour in the presence of human beings suggests that predation is a mortality factor of some significance.

5. *Afrotroglorrhynchus* (*nivalis*?) Hust.

Only two specimens of the beetle belonging to the genus *Afrotroglorrhynchus* were collected while beating *Alchemilla johnstonii* Oliv. This species seems to be very near *A. nivalis* Hust., but according

to Dr. Edward Voss* it could be a different species. Jabbal (1968) is at present in the process of describing it as a new species, *Afrotroglorrhynchus kazitae*. Since this beetle is of relatively small size (4.8 mm.) and not very common, it is probably of no quantitative ecological importance.

DISCUSSION

The unique feature of Afro-montane regions is their remarkable diurnal temperature range, under whose influence an animal may be submitted to sub-zero every night and intense heat and low humidity during the day. Hedberg (1957) called this type of climate "winter every night and summer every day". The relative humidity, which in these regions fluctuates daily with the temperature and cloud cover, has been described by Coe (1967): "at ground level the relative humidity just before sunrise was 90%, when the sun rose this figure fell within about 90 minutes to below 20%; when during the course of the day the sun became obscured by cloud, the figure rose to 80%". In such a climate with large and regular diurnal temperature changes it is not so much the extremes, but rather the speed with which they fluctuate, that is the main controlling factor on insect life.

The atmosphere becomes thinner as the altitude increases, thus resulting in lesser heating of the air during the passage of solar radiation. The most important component of this incoming radiation is the ultraviolet. While considering the climate near the ground Geiger (1950) quotes the work of Maurer, who found that the amount by which ground temperature exceeds that of the air increases with altitude, a factor of obviously great significance to microclimate in the equatorial mountains. During the day the outward radiation from the ground and vegetation is not very apparent but at high altitudes its effect is of great importance as an additional cooling agent at the surface and in consequence this effect may be strongly felt by the invertebrates occupying the microhabitats. The sudden lowering of temperature does not, however, penetrate more than a few inches below the, surface of the soil—4 to 6 inches below the ground level, the temperature was found to be c6°C. So in large part, the protective insulating mechanisms that have been developed by the vegetation are fully utilized by the invertebrate fauna.

The activity of insects in such areas is greatly limited and seems to take place in bursts of short duration whenever circumstances are favourable. At night the intense cold renders them incapable of movement, while during the day, except for a short period after sunrise and just before sunset, the ground temperature is far too high and humidity too low. Thus, not surprisingly, it is due to these two factors that a high percentage of arthropods exhibits sedentary and cryptozoic habits, which keep them within or close to the comparatively constant microclimate of their shelters. Examples of this are *Cossonus* in the *Lobelia* rachis and *Parasystates* in the *Festuca* tussock. None of the observed species showed any evidence of rhythmic control over activity.

Morphological factors seem to play an important role in the adaptation of invertebrate life to the alpine climate. The highly reflective surface of some of the beetles like *Parasystates elongatus* is probably a means of protection against radiation. The predominantly dark colours of almost all the weevils collected could be important in heat absorption. It is probably an advantage to absorb heat quickly in the early morning, so that the animal can complete its main period of activity before the ground becomes too hot. All the Curculionids collected possess inflated elytra whose enclosed air could have an important insulating function.

One point of evolutionary interest is the fusion of the elytra and absence of wings in most of the alpine Curculionids. This aptery or brachyptery is a common phenomenon of high altitude insects and Mani (1962) suggests the obvious selective advantage of such a modification. He points out that a flying insect can easily be carried by up-currents on the barren peak region or swept off the mountain altogether. The winds on East African mountains, however, are not generally as strong as those on the Himalayas. Thus, whether the presence of flightless insects on Mount Kenya represents a selective survival of apterous species which have colonized the mountain or whether it represents the evolution of apterous species from normal, winged species after colonization of the mountain is very much a matter of speculation.

During the March 1966 expedition, no attempt was made to collect the smaller species of the family Curculionidae. Yet, of the thirty two previously described species for Mount Kenya four were encountered, and one new species was found (*Afrotroglorrhynchus kazitae* n. sp.). This indicates that a systematic survey of the alpine regions of Mount Kenya will probably uncover a considerable number of weevils as yet undescribed.

The purpose of this expedition was to study the ecology of the northern slopes of the alpine zone of Mount Kenya. The work on Curculionidae as reported above throws some light on the role played by the larger and more abundant species of this family in biological interrelationships. The rarer and smaller species must also play some role in the ecology of this region. At present this role seems to be of little quantitative importance, however, it requires a closer study.

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*Dr. Edward Voss of 4501 Hardenberg, Am Boberg 2, B. R. Deutschland, kindly examined our specimens.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the Director of the Kenya National Parks and to Mr. Bill Woodley for their co-operation. The work was supported by a Ford Foundation grant for Ecological research to the Zoology Department of University College, Nairobi.

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APPENDIX I

CHECKLIST OF CURCULIONIDAE COLLECTED FROM THE MOORLAND AND ALPINE ZONES OF MOUNT KENYA

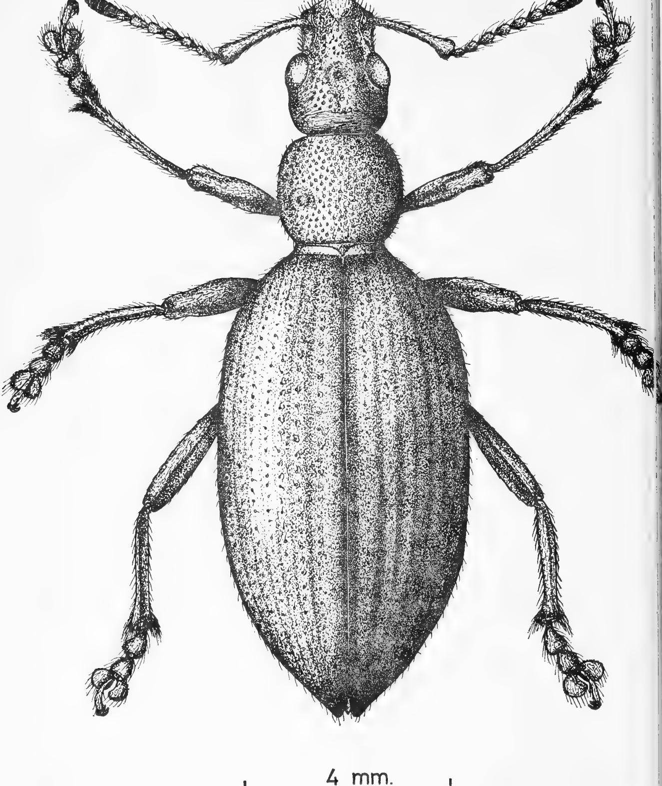
All the names marked * are in the collection of the National Museum of Kenya.

Name Authority	*Collector and Date*	*Altitude*	*References*
A. **Subfamily**: *Otiorrhinchinae*			
1. *Amphitemetus griseus* Hust.	Alluaud & Jeannel 1912	9,200 ft. and 10,500 ft.	Hustache (1929) pp. 384–385.
2. **A. sulcipennis* Hust.	Alluaud & Jeannel 1912	9,200 ft. and 10,500 ft.	Hustach (1929) pp. 385–387.
	Joy Peter Bally Nov. 1943	10,500 ft.	
	Mrs. Bally Jan. 1964	10,500 ft.	
	Jabbal & Harmsen March 1966	12,500 ft.	
3. *Leptospyris sylvaticus* Hust.	Alluaud & Jeannel 1912	9,200 ft. and 10,500 ft.	Hustache (1929) pp. 401–402.
4. *L. glacialis* Hust.	Alluaud & Jeannel 1912	13,100 ft. and 14,400 ft.	Hustache (1929) pp. 402–403.
5. *L. laevis* Hust.	Alluaud & Jeannel 1912	13,100 ft. and 13,400 ft.	Hustache (1929) pp. 403–404.
6. *Parasystates albovittatus* Auriv.	Alluaud & Jeannel 1912	9,200 ft. and 10,500 ft.	Hustache (1929) p. 406.
7. **P. elongatus* Hust.	Alluaud & Jeannel 1912	7,900 ft. and 14,400 ft.	Hustache (1929) pp. 407–408.
	A. J. F. Gedye Dec. 1943	13,500 ft.	
	Museum Staff Jan. 1947	12,150 ft.	
	F. C. Delkirk Feb. 1950	14,850 ft.	
	Harmsen & Jabbal, 1966	12,500 ft.	
8. *P. alternans* Hust.	Alluaud & Jeannel 1912	10,800 ft– 11,500 ft.	Hustache (1929) pp. 408–409.
9. *P. nigripennis* Hust.	Alluaud & Jeannel 1912	7,900 ft. and 10,500 ft.	Hustache (1929) pp. 410–411.
10. *P. alpinus* Hust.	Alluaud & Jeannel 1912	7,200 ft.– 10,200 ft.	Hustache (1929) pp. 413–414.
11. *P. brunneus* Hust.	Alluaud & Jeannel 1912	9,200ft.– 10,500 ft.	Hustache (1929) pp. 414–415.
12. *Systates elongatus* Hust.	Alluaud & Jeannel 1912	7,900 ft. 9,200 ft. and 10,500 ft.	Hustache (1929) pp. 424–425.
13. *Barypeithes microphthalmus* Hust.	Alluaud & Jeannel 1912	9,200 ft.– 10,500 ft.	Hustache (1929) pp. 450–451.
14. *Omias* (*Neomias*) *kenyae* Hust.	Alluaud & Jeannel 1912	9,200 ft.– 10,500 ft.	Hustache (1929) pp. 451–452.
15. *O.* (*Neomias*) *kenyae* var. *glacialis* Hust.	Alluaud & Jeannel 1912	13,100 ft.– 13,400 ft.	Hustache (1929) p. 452.
16. *O.* (*Neomias*) *alpinus* Hust.	Alluaud & Jeannel 1912	10,800 ft.– 13,400 ft.	Hustache (1929) pp. 452–457.
B. **Subfamily**: *Cleonidae*			
17. *Lixus nycterophorus* var. *kenyae* Hust.	Alluaud & Jeannel 1912	7,900 ft.– 8,900 ft.	Hustache (1929) p. 474.
18. **L. alpinus* Hust.	Mrs. Bally Jan. 1944	10,500 ft.	Hustache (1929) p. 475.

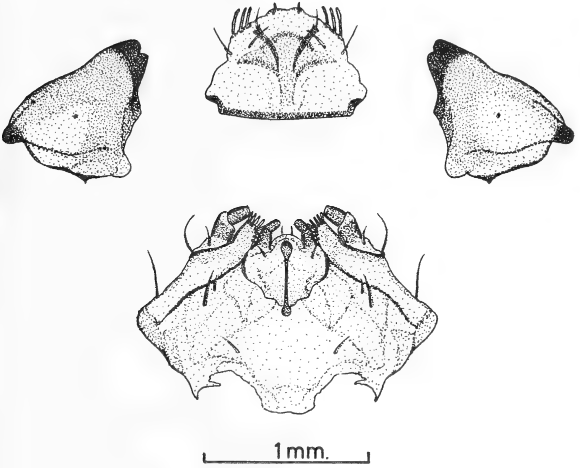
Name Authority	*Collector and Date*	*Altitude*	*References*
19. **L. adspersus* Boh.	Mrs. Bally Jan. 1944		Boheman (1871) *Fahrs. Oefrers. Vet. Akad. Forh.* **18**: 58, 230.
C. **Subfamily**: *Rhyparosominae*			
20. **Oreoscotus fulvitarsus* Hust.	Alluaud & Jeannel 1912	10,800 ft. and 11,500 ft.	Hustache (1929) pp. 465–466.
	A. J. F. Gedye Dec. 1934	10,000 ft.	
	Museum Staff Jan. 1947	12,150 ft.	
	Mrs. Bally Jan. 1944	10,500 ft.	
D. **Subfamily**: *Eirrhininae*			
21. *Homoedenodema fulva* Hust.	Alluad & Jeannel 1912	9,200 ft. and 10,500 ft.	Hustache (1929) pp. 483–484.
E. **Subfamily**: **Apioninae**			
22. *Apion warendorffi* Wagner	Alluad & Jeannel 1912		*Mem. Soc. Ent. Belg.* **19**: **41.**
F. **Subfamily**: **Baridinae**			
23. *Baris kenyae* Hust.	Alluad & Jeannel 1912	9,200 ft. and 10,500 ft.	Hustache (1929) pp. 531–533.
G. **Subfamily**: *Cossoninae*			
24. *Mimus glacialis* Hust.	Alluaud & Jeannel 1912	9,400 ft.	Hustache (1929) pp. 544–545.
25. **Cossonus* (or *Afrocossonus*) *hyperboreus* Hust.	Alluaud & Jeannel 1912	10,800 ft. and 11,700 ft.	Hustache (1929) pp. 545–546.
	Museum Staff Jan. 1947	12,150 ft.	
26. *C. dorytomoides* Hust.	Alluaud & Jeannel 1912	10,800 ft. and 12,100 ft.	Hustache (1929) pp. 547–548
27. **C. frigidus* Hust.	Alluaud & Jeannel 1912	13,100 ft. and 14,400 ft.	Hustache (1929) pp. 549–550.
	Museum Staff Jan. 1947	12,150 ft.	*Rev. Zool. Bot. Afr.* (1934) **26**: 36.
	A. J. F. Gedye Dec. 1934	13,800 ft.	
	Jabbal & Harmsen March 1966	12,500 ft.	
28. **C.* (or *Pseudomesites*) *glacialis* Hust.	Alluaud & Jeannel 1912	10,800 ft. and 12,100 ft.	Hustache (1929) pp. 552–553.
	A. J. F. Gedye Dec. 1934	13,800 ft.	*Rev. Zool. Bot. Afr.* (1934). **26**: 36.
	Museum Staff Jan. 1947	11,000 ft.	
H. **Subfamily**: *Otiorrhinchinae*			
29. **Seneciobius basirufus* Mshl.	Mrs. Bally Aug. 1934	12,000 ft.	*J. E. Afr. Nat. Hist. Soc.* (1950). **19**, 5: 147.
	Mrs. Bally Jan. 1944	10,500 ft.	
	Museum Staff Jan. 1947	12,150 ft.	
	Jabbal & Harmsen March 1966	12,500 ft. and 14,000 ft.	

Name Authority	Collector and Date	Altitude	References
30. **S. semilucens* Mshl.	A. K. Hading 1949	11,000 ft.	*J. E.A. Nat. Hist. Soc.* (1950). **19,** 5:147
31. **Strictoseneciobius ebininus* Hust.	Mrs. Bally 1944	10,500 ft.	*Ann. Mag. Nat. Hist. London* (1940). (11) **13**:93–98
32. **Seneciobius loveni* Aur. or *granulipennis* Hust.	A. K. Hading 1949	13,000 ft.	*Rev. Zool. Bot. Afr.* (1923) **11** 188. *Ann. Mag. Nat. Hist.* (1934). (10) **15**:503

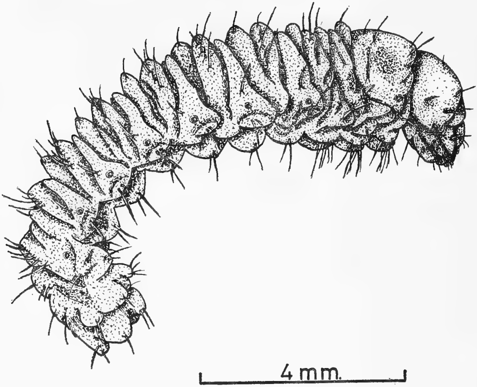
(*Received 30th January 1968*)



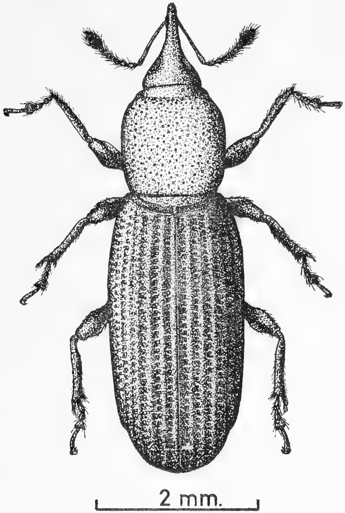
Parasystates elongatus Hust.



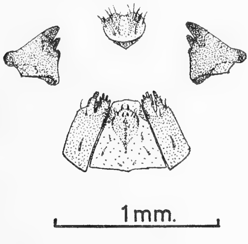
Mouth parts of the larva of *Parasystates elongatus*



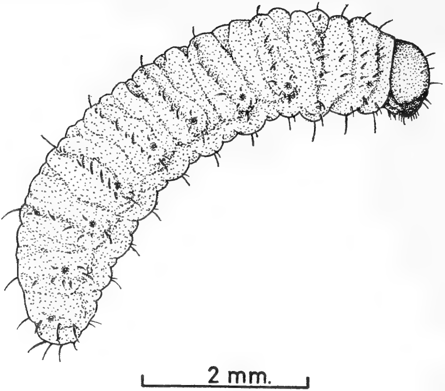
Larva of *Parasystates elongatus*



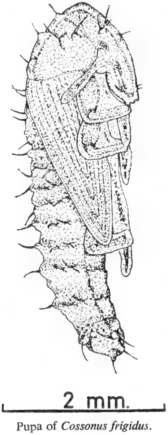
Cossonus frigidus Hust.



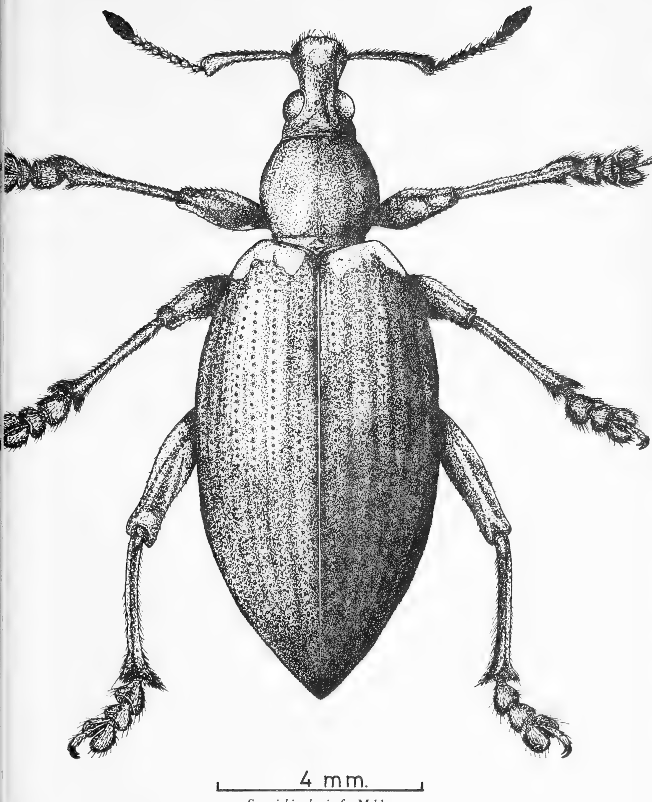
Mouth parts of the larva of *Cossonus frigidus*.



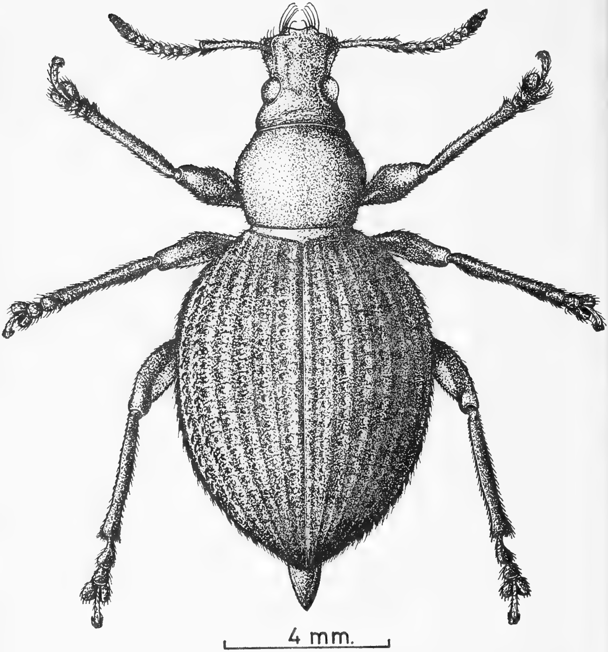
Larva of *Cossonus frigidus*.



Pupa of *Cossonus frigidus*.



Seneciobius basirufus Mshl.



Amphitemetus sulcipennis Hust.

RECORDS OF PARASITIC NEMATODES IN KENYA

GERALD D. SCHMIDT
(*Department of Biology, Colorado State College*)
AND
ALBERT G. CANARIS
(*Department of Zoology, University of Montana, Missoula, Montana*)

Among the helminth parasites collected by the second author in Kenya from 1962 to 1965 were several species of nematodes, reported herein. Specimens were fixed in AFA and cleared in glycerin for study. Rare species are deposited in the USNM Helminthological Collection, Beltsville, Maryland. The results of this study are reported in Table 1.

TABLE I
NEW RECORDS OF PARASITIC NEMATODES IN KENYA

Host	*Location*	*Examined*	*Infected*	*Locality*	*Parasite*
FISH					
Black bass *Micropterus salmoides* Lacép.	intestine	1	1	Lake Naivasha	*Porrocaecum* sp. (Juv.)
Tilapia *Tilapia* sp.	intestine	2	1	Lake Naivasha	*Porrocaecum* sp. (Juv.)
AMPHIBIANS					
Bullfrog *Pyxicephalus delandii* Tschudi	cyst on gut	4	1	Mt. Suswa	*Agamofilaria* sp. (*Icosiella*?) (Juv.)
Toad *Bufo regularis* Reuss	small intestine	4	4	Njoro	*Aplectana dogieli* (Skrjabin, 1916)
	lungs	4	2	Njoro	*Rhabdias* sp.
Grass frog *Rana angolensis* Bocage	intestine	30	24	Njoro	*Amphibiophilus acanthocirratus* (Skrjabin, 1916)
	intestine	30	9	Njoro	*Falcaustra* sp. (*Spironoura*)
REPTILES					
Python *Python sebae* (Gmelin)		2	0	Lake Solai, Njoro	
Mole snake *Pseudaspis cana* (Linnaeus)	stomach & intestine	1	1	Njoro	*Kalicephalus colubri* (Ortlepp, 1923)
Purple-glossed snake *Chamaetortus aulicus* Günther	intestine	1	1	Watamu	*Thubunaea asymmetrica* Baylis, 1930
Puff adder *Bitis arietans* (Merrem)	intestine	1	1	Njoro	*K. colubri*
Kenya horned viper *Bitis worthingtoni* Parker		2	0	Njoro	

Host	*Location*	*Examined*	*Infected*	*Locality*	*Parasite*
House gecko *Phyllodactylus* sp.	stomach cloaca	2	1	Watamu	*T. asymmetrica* *Pharyngodon mabuiensis* (Mala, 1939)
Chameleon *Chameleo dilepis* Leach	small intestine	14	3	Njoro	*Strongyluris brevicaudata* (Mueller, 1894)
Skink *Mabuya homalocephala* (Wiegmann)	stomach	2	1	Watamu	*T. asymmetrica*
BIRDS					
Black river duck *Anas sparsa* Egton	small intestine	3	1	Njoro	*Porrocaecum crassum* (Deslongchamps, 1824)
Speckled pigeon *Columba guinea* Linnaeus		2	0	Njoro	
Olive pigeon *C. arquatrix* Temminck & Knip	small intestine	5	2	Njoro	*Ascaridia columbae* (Gmelin, 1790)
Pink-breasted dove *Streptopelia lugens* (Rüppell)		4	0	Njoro	
Red-eyed dove *S. semitorquata* (Rüppell)		2	0	Njoro	
Tambourine dove *Tympanistria tympanistria* (Temminck & Knip)		1	0	Naivasha	
Green pigeon *Treron australis* (Linnaeus)	small intestine	12	7	Njoro	*A. columbae*
MAMMALS					
Mole rat *Tachyoryctes* sp.	stomach	2	1	Njoro	*Ascarops africana* (Sandground, 1933)
Striped grassmouse *Rhabdomys pumilio* (Sparrman)	small intestine	2	2	Njoro	*Longistriata impudica* (Baylis, 1928)
Serval cat *Felis serval* Schreber	intestine	1	1	Mau Forest (Njoro)	*Ancylostoma paraduodenale* (Biocca, 1951) *Toxocara* sp.
Elephant *Loxodonta africana* (Blumenbach)	intestine	1	1	Mau Forest (Molo)	*Quilonia magna* (Neveu-Lemaire, 1928)
	Totals	101	56	individuals infected with one or more species of round worms	

ACKNOWLEDGEMENTS

The authors are indebted to Dr. Roy C. Anderson, University of Guelph, for his opinions on the identity of the frog filariid, and to Mr. John Williams, Curator of Birds, Kenya National Museum, who assisted with host determinations.

(*Received 11th March 1968*)

DISTRIBUTION AND HOST-SPECIFICITY OF A NUMBER OF FLEAS COLLECTED IN SOUTH AND CENTRAL KENYA

(Including the Collection of the University College, Nairobi, Mount Kenya Expedition, March 1966)

by

R. HARMSEN*

*Presently at University of Toronto, Toronto, Ontario, Canada,

I. JABBAL

(*Zoology Department, University College, Nairobi*)

During the years 1963–1966 a collection of fleas was made by various members of the Department of Zoology of University College, Nairobi (UCN). This collection was mainly based on Dr. J. B. Foster's trapping of small mammals, and on the fieldwork of Dr. J. B. Sale with hyrax. Some specimens, however, were collected occasionally from road kills and other incidental mammalian hosts. The collection culminated with the work of the University College Mount Kenya Expedition in March 1966. The collection was mounted and identified by members of the Division of Insect-Borne Diseases (DIBD), Medical Department, Kenya, and a number of specimens were sent to Mr. F. G. A. M. Smit, Zoological Museum, Tring, England, for confirmation of identification.

The present records of distribution and host-specificity are of interest for a variety of reasons. Fleas only spend their adult life in intimate contact with the mammalian host, the larva is a free living insect, feeding on proteinaceous detritus. It is, therefore, to be expected that fleas will be mainly found on those mammals which have permanent dwelling sites, and particularly on nest or den building animals. This is the immediate effect of the need of a freshly emerged adult flea to contact a new host. Flea eggs deposited in a nest or den have a much higher chance of developing into adults within the immediate reach of a new host than flea eggs deposited at random in the field. One other consequence of this necessity of the flea to locate a host within its life time after larval development away from the host, is a dependence on the climate.

It is, thus, to be expected that within the fairly narrow geographical confines of Kenya a number of flea species will be restricted to particular altitudinal levels in response to a climatic adaptation, even when suitable hosts are available at other altitudes. Alternatively, one would expect to find fleas restricted to particular hosts at one altitude, and to other hosts at another altitude, this in response to the combined effect of climate and nesting habits of different hosts. This form of ecologically based isolation could well become the basis of speciation.

The Collection

The following species were collected and identified:

Chimaeropsylla potis potis
Ctenocephalides felis strongylus
Ctenophthalmus cophurus
Ctenophthalmus lycosius
Delopsylla crassipes
Dinopsyllus longifrons
Dinopsyllus lypusus
Echidnophaga aethiops
Nosopsyllus incisus
Procaviopsylla procaviae
Xenopsylla cheopis
Xiphiopsylla hyparetes
Xiphiopsylla levis

For each species a number of notes concerning distribution, ecology and host specificity are of significance.

In the following account all names of mammalian hosts in the paper follow Allen (1939) and the following symbols refer to location of specimens.

*For Rothschild collection, Tring, England.
†For UCN Zoology Dept. Nairobi.
‡For DIBD collection Nairobi.

1. *Delopsylla crassipes* Jordan, 1926a; (Pulicidae).

This species of flea is only known from the Kenya Highlands with previous records from the Nairobi and Nakuru areas. It is only known from the springhaas, *Pedetes surdaster* Thomas.

In February 1964, Foster collected one hare, *Lepus capensis* Linnaeus, and two springhaas in a small area on the Kapiti plains to the S.E. of Nairobi. From the springhaas 2 ♂♂‡ and 3 ♀♀‡ of *Delopsylla crassipes* were collected, from the hare 1 ♀† only. This record of *D. crassipes* on a hare is not necessarily an indication of this flea selecting the hare as a host. Several other hares have been collected in areas nearby, but not within a springhaas colony; on these hares, fleas were usually encountered, but never *D. crassipes*. It is therefore likely that this flea is indeed a highly host-specific species, which is merely carried temporarily by other furry hosts such as the hare.

2. *Echidnophaga aethiops* Jordan & Rothschild, 1906; (Pulicidae).

This flea is well known as a bat flea, associated mainly with the bat genus, *Nycteris*. It has been collected over a wide area of South and Central Africa (South Africa, S.W. Africa, Somalia and the Tsavo region of Kenya) (Jordan & Rothschild, 1906; 1913; Hopkins & Rothschild, 1953), but is not common.

In January 1964, Foster collected a bat, *Nycteris thebaica* Geoffroy, at Olorgesailie, approximately 45 miles S.W. of Nairobi in the Rift Valley. The fleas (8♀♀)† were restricted to the inside of the ear where they were attached by their proboscis to the membranous skin of the bat. The location and host fit very well within the previously recorded area for this flea. It seems likely, therefore, that *E. aethiops* is exclusively a bat flea and restricted to the genus *Nycteris* in the arid regions of Southern and Eastern Africa. On the basis of this single collection, it is impossible to attach any significance to the sex ratio (8♀♀, no ♂♂). Other collections have, on the whole, also had a very much larger number of ♀♀ than of ♂♂ (de Meillon, Davis & Hardy, 1961).

3. *Xenopsylla cheopis* (Rothschild), 1903; (Pulicidae).

This species is known from the entire world, including Australia and many oceanic islands (Hopkins & Rothschild, 1953). It parasitizes a large number of rodents including *Rattus rattus* (Linnaeus), which may well be the reason for it being found on so many islands. It is most likely correct to think of this species as a rodent flea, although it has been collected from such animals as genet, shrews, and man, but these records could easily be interpreted as stray specimens being temporarily harboured by non-host mammals which live in close proximity to one of the real hosts.

In February 1964, Foster collected two small rats, *Grammomys surdaster* (Thomas & Wroughton), at the foot of Lukenya Hill (20 miles S.E. of Nairobi) on which one ♀† and 2 ♂♂† of *X. cheopis* were found. Among the hosts listed in the literature (Hopkins & Rothschild, 1953) *Grammomys* is not listed, and is probably a new record. It is, of course, not at all surprising, as *X. cheopis* is known from a large number of small rodent species.

4. *Procaviopsylla procaviae* (C. Fox), 1914; (Pulicidae).

All records of this species of flea are from the elevated regions of Kenya and Tanzania, and all but one are from *Procavia* spp. or *Heterohyrax* spp. (Fox, 1914; Jordan, 1925; 1926b). One isolated record from a dikdik, *Rhynchotragus kirki* (Günther), may well be an example of a non-host carrier (Hopkins & Rothschild, 1953). It is, however, interesting to note that the dikdik is, like the hyrax, a small ungulate.

On two occasions (Feb. 1964 and Dec. 1965), Sale captured a number of specimens of *Heterohyrax syriacus* (Schreber) on Lukenya Hill (20 miles S.E. of Nairobi). On both occasions fleas were found on all or some of the hyrax, and a representative collection was made (26♀♀ and 13♂♂)‡. All specimens were identified as *P. procaviae*.

The present records confirm the opinion that *P. procaviae* is most likely a highly host-specific species restricted to a rather small geographical area and to a limited altitudinal range, in that on several hyrax collections from Mt. Kenya no fleas were encountered.

5. *Ctenocephalides felis strongylus* (Jordan), 1925; (Pulicidae).

This generally common species of flea is known from nearly all regions of Africa south of the Sahara and from several islands of the Indian Ocean. It is mainly known from low lying areas, but some records exist from highland areas in East Africa. It appears to be highly non-selective in host choice; records exist for many different species: several groups of predators, ungulates including hyrax, primates including man, rodents, insectivores and lagomorphs (Hopkins & Rothschild, 1953).

On the hare, *Lepus capensis*, collected in the springhaas colony on the Kapiti plains which harboured one specimen of *D. crassipes*, were found 2 ♂♂† and 3 ♀♀† of *C. felis strongylus* Of this latter species of flea, 1 ♂† and 1 ♀† were found on one of the springhaas, *Pedetes surdaster*, as well. It is impossible to determine whether the springhaas was a host or a carrier of *Ctenocephalides*. The very general host selection, however, would suggest that *Pedetes* could be considered as a host. A further 6 ♂♂† and 8 ♀♀† of *C. felis strongylus* were collected from a hare, *Lepus capensis*, in Nairobi National Park in March 1964, 7 ♂♂† and 5 ♀♀† from the rat, *Cricetomys gambianus* Waterhouse, which died after being in captivity for two years in Nairobi, 1 ♀* only from the rat, *Lophuromys aquilus* (True), collected by Foster on March 1, 1964 at 10,000′ altitude on the Aberdare Range, 1 ♂† and 31 ♀♀† from a hedgehog, *Atelerix pruneri* (Wagner), collected in 1960 in Nairobi, 1 ♀† only from an elephant shrew, *Petrodromus sultan* Thomas, collected by Foster on March 17, 1964 on Mrima Hill (30 miles S.W. of Mombasa), 1 ♀† from a zorilla, *Ictonyx striatus* (Perry), and 3 ♀♀† from another

zorilla, both collected on Lukenya Hill in February 1964, 1 ♂† and 3 ♀♀† from a civet, *Civettictis civetta* (Schreber), collected on March 5, 1964 near Langata, Nairobi and 1 ♂† and 7 ♀♀† from a live domesticated African bush cat, *Felis lybica* Forster, in Nairobi, in April 1964. The artificial conditions under which *C. felis strongylus* was collected from *Cricetomys* makes this record highly suspect. The collection from the Aberdares is the highest altitude record for this species. It is of interest to note that *Ctenocephalides* was not encountered on Mount Kenya among the collections made at 12-14,000′ altitude. Both rodent genera *Cricetomys* and *Lophuromys* are previously known as host genera. The hedgehog does not seem to be listed in the literature as a host, but this may well be a technical omission. The collection from zorilla, civet and bush cat fall completely within the main host range of this species of flea. The elephant shrew, *Petrodromus sultan*, is likely a new host record, although a different elephant shrew, *Macroscelides tetradactylus* (Peters), is known as a host, and *C. felis felis* is known from *Petrodromus* on the Kenya coast (Hopkins & Rothschild, 1953). This last record is in itself of interest. It seems hard to imagine that *C. felis felis* and *C. felis strongylus* would occur sympatrically and on the same hosts. This casts doubt on the subspecific status of these forms. Only a careful analysis of all previous records and possibly breeding experiments could decide on the status of these two forms.

6. *Nosopsyllus incisus* Jordan & Rothschild, 1913; (Ceratophyllidae).

A relatively rare species, known from a small number of rat-like rodents from elevated areas in East and Central Africa (Hopkins, 1947).

During the Mt. Kenya expedition of March 1966, two dormice, *Clavigilis murinus* (Desmarest), were collected in the upper Kazita West valley, carrying fleas of this species. One, at 12,500′ altitude carried 2 ♀♀* and the other at 13,500′ carried one ♂*. It is quite obvious that at this extreme altitude *Nosopsyllis incisus* is restricted to *Clavigilis*, other rodents collected in the same area carried other species of flea, but not *Nosopsyllus*. The dormouse is a new host reocord, and previously, *N. incisus* has not been collected over 10,000′ altitude. It is interesting that this species of flea is found on, for instance, *Lophuromys* at lower altitudes, but was not found on this rat at higher altitude. Perhaps nesting habits of different rodents restrict the host specificity of *Nosopsyllus* at high altitudes.

7. *Xiphiopsylla levis* Smit, 1960; (Xiphiopsyllidae).

This is a typical high altitude species known from small rodents on Mts. Elgon and Kenya, the Aberdares and from the Eastern Congo.

During the Mt. Kenya expedition, this flea was encountered as one of the commoner ectoparasites of the very abundant groove-toothed rat, *Otomys orestes* Thomas, at all sites in the upper Kazita West valley between 12,000′ and 14,000′ altitude. It did, however, show no distinct host specificity, being also collected from other small rodents and one specimen from a shrew. The details of the collected specimens being: 3 ♀♀* from an *Otomys orestes* trapped on March 20, 1966 at 12,500′ altitude, 1 ♀* from an *O. orestes* trapped on March 21, 1966 at 13.500′ altitude, 1 ♂* from another *O. orestes* trapped on March 21, 1966 at 13,500′ altitude, 1 ♂* and 1 ♀* from a dormouse, *Clavigilis murinus*, trapped on March 21, 1966 at 13,500′ altitude, 1 ♀* from a climbing rat, *Dendromus insignis* Thomas, trapped on March 23, 1966 at 13,500′ altitude, and 1 ♀* from a shrew, *Crocidura turba* Dollman, trapped on March 28, 1966 at 12,500′ altitude.

The above records strengthen the opinion that *X. levis* is a high altitude flea of small rodents. *Clavigilis* and *Dendromys* are new host genera. The record of one specimen collected from a shrew must be regarded with suspicion, especially since the shrew was briefly in contact with an *Otomys* after being killed.

8. *Xiphiopsylla hyparetes* Jordan & Rothschild, 1913: (Xiphiopsyllidae).

This rare species of *Xiphiopsylla* is also a high altitude flea, but is not known from extreme altitudes. It is only recorded from Kenya (Aberdares and Keruguya) and Eastern Congo. The only hosts on record are *Lophuromys* and *Rattus* (Jordan & Rothschild, 1913; Hopkins, 1947).

On March 1, 1964, Foster collected one ♂* of this species on a *Lophuromys aquilus* trapped on the Aberdares at 10,000′ altitude. It is significant that with so few previous records for this flea the one new record is from both a known location and a known host, strongly suggesting a very limited range and host selection.

9. *Chimaeropsylla potis potis* Rothschild, 1911; (Hypsophthalmidae).

The only hosts known for this flea are elephant shrews of the genera *Rhinonax* and *Rhynchocyon*, and its distribution is limited to Malawi and the East African coastal strip (Hopkins & Rothschild, 1956).

In March 1964, Foster collected 2 ♂♂‡ and 1 ♀‡ from a freshly killed elephant shrew, *Petrodromus sultan*, on Mrima Hill, 30 miles S.W. of Mombasa. This record strengthens the opinion that *C. potis potis* is a highly host specific flea, restricted to elephant shrews.

10. *Ctenophthalmus lycosius* Jordan & Rothschild, 1913; (Hystrichopsyllidae).

This flea is very rare; only few records are available. It is only known from the Aberdares and Mt. Kenya, previously collected between 6,000′ and 11,000′ altitude (Hopkins & Rothschild, 1966).

The rats, *Lophuromys flavopunctatus* Thomas, and the shrew, *Crocidura fumosa* Thomas, are known as hosts.

During the Mt. Kenya expedition, the flea was collected three times, all from *Otomys orestes:* 2♂♂‡ on March 21, 1966 at 12,500′ altitude, one further ♂‡ on March 21, 1966 at 12,500′ altitude, and 2♀♀* on March 23, 1966 at 13,500′ altitude. It is interesting that this flea was not encountered on either *Lophuromys* or *Crocidura*, both species being present in the same collecting area.

11. *Ctenophthalmus cophurus* Jordan & Rothschild, 1913; (Hystrichopsyllidae).

As the previous species, this one has a very restricted distribution in East Africa, is known from high elevations only, but has previously been collected from a variety of small rodents.

Two collections of this flea were made during the March 1966 Mt. Kenya expedition: 1♂‡ and 3♀♀‡ from *Crocidura allex* Osgood and 1♂‡ from the moleshrew, *Surdisorex polulus* Hollister, both at 12,500′.

It is of interest that both of these records are from insectivore hosts, and that none of the rodents (including *Lophuromys*) that were trapped on the alpine zone of Mt. Kenya carried this species of flea.

12. *Dinopsyllus longifrons* Jordan & Rothschild, 1913; (Hystrichopsyllidae).

This is also a highland species. It is somewhat better known than both *Ctenophthalmus* species. Its range covers most elevated areas of East Africa, Congo, Zambia and Malawi. As hosts are listed several species of *Otomys* and a few other rodents.

During the March 1966 Mt. Kenya expedition, this flea was found on nearly all specimens of *Otomys orestes* collected. It was encountered at all elevations between 12,000′ and 14,000′ altitude. A total of 17♀♀‡ and 11♂♂‡ were collected, of this common flea in the Kazita West valley.

It is particularly interesting to note that despite its relative abundance on *Otomys* this flea was not found on any other animal. Such extreme host specificity has not previously been reported for this species, and may well be the result of the extreme conditions of the alpine zone.

13. *Dinopsyllus lypusus* Jordan & Rothschild, 1913; (Hystrichopsyllidae).

This fairly common species is widely distributed throughout East and Central Africa, and is known from a wide variety of small rodents. One ♀† was collected from a small rat, *Grammomys surdaster*, which was trapped on Lukenya Hill (20 miles S.E. of Nairobi) in February 1964 by Foster.

DISCUSSION

The danger of considering any animal carrying a flea the host of that particular flea is well illustrated in the case of *Delopsylla crassipes*, which is obviously a highly host specific flea, restricted to the springhaas, *Pedetes surdaster*. It was, however, also found on the hare, *Lepus capensis*, but only on those hares which live within the confined area of a springhaas colony. Similarly, *Xenopsylla cheopis*, *Xiphiopsylla levis* and *Ctenophthalmus lycosius*, all three typical rodent fleas have been collected from man, small predators and shrews. Again, the non-rodent records are most likely of strays, even though *X. cheopis* is known to bite man, and thus become a possible distributor of plague. On the other hand, the record of a flea on a vertebrate other than its normal host(s) does not necessarily mean that it is a stray. This situation is well illustrated by *Ctenophthalmus cophurus*, which although listed as a rodent flea, has been collected from two species of shrew. The relationship between rodents and shrews is remote, and yet, there appears a considerable overlap of rodent and shrew use for a number of flea populations. The extent of the overlap is such that accidental straying and carrying seems most unlikely, especially since some other species, such as *Dinopsyllus longifrons* and *Nosopsyllus incisus* have been found in relatively large numbers on rodents, but not at all on shrews. Could it be possible that those rodent fleas found consistently on shrews in certain locations (like the alpine zone of Mt. Kenya) are in fact evolving very rapidly in response to the extreme environment? It could be hypothesized that certain species of rodent flea take advantage of a shrew population for dispersal purposes, but under normal conditions it is not of selective advantage to derive blood from the shrews or breed in shrews' nests. Under special conditions of the alpine zone, however, this balance may be upset, and some flea species could evolve so as to switch completely and become exclusively host specific for shrews. The flea, *Ctenophthalmus cophurus*, illustrates this situation. The subspecies, *C. c. cophurus*, is known only from rodents at altitudes between 6,000′ and 11,000′ in the Kenya and Uganda highlands, *C. c. hemmingwayi* is also from rodents at similar altitudes, but in the Kilimanjaro region. The specimens of *C. cophurus* from the alpine zone of Mt. Kenya were all collected from shrews, none were encountered on the large sample of the rodent population. It seems likely that these latter specimens represent a new subspecies in a stage of development, where they can not yet be recognized morphologically, but where they are a completely isolated population as a result of their regional host specificity.

The nesting ecology of rodents and shrews in the extreme climatic conditions of the alpine zone of Mt. Kenya is as yet not known. In order to understand the host (and carrier) selection of fleas in this region much more will have to be learned concerning the small mammals. One glimpse into this field is provided by the records of the flea, *Nosopsyllus incisus*, which was found on Mt. Kenya restricted to the dormouse, which builds an elaborate nest, while at lower elevations the same flea is found on other rodents as well. It appears plausible that it is only the nesting habit which at the climatic conditions of the alpine zone restricts *N. incisus* to the dormouse.

As illustrated in *N. incisus* and *C. cophurus*, the combination of climatic conditions and the nesting habits of small mammals result in increased host specificity of fleas. This will be a more or less effective isolation of fairly small, altitude restricted, populations. This, in turn, could lead to genetic variation and speciation. Indeed, evidence is available for such localized speciation. *Procaviopsylla procaviae* is found only to the south of Nairobi, while on the Ngong Hills and further north a very close, but distinct species *P. isidis* is found (Hopkins, 1947). Hopkins & Rothschild (1966) consider *Dinopsyllus longifrons* a fluid species, only "typical" at altitudes above 10,000′ in East Africa. Records from lower altitudes (6,000′–10,000′) appear to differ sufficiently to warrant a sub-specific separation. They further consider *D. lypusus* of lower altitudes yet another sub-species of the same group, and *D. tenax* of South Africa is possibly a very recent offshoot of ths group as well. It is of interest to note that here, like in *C. cophurus* and *N. incisus*, the high altitude (i.e. over 10,000′) collections are much more host specific than the lower altitude collections.

Finally, one problem must be mentioned. A number of species appear to be restricted not to one small high altitude region, but to a number of rather widely separated, completely isolated regions such as Mt. Kenya, Mt. Elgon, and the Ruwenzori. A number of explanations are possible. Perhaps the isolation is far less effective than our collecting records suggest, or alternatively the adaptive evolution to high altitude conditions has proceeded along so closely resembling parallel lines, that the results are morphologically indistinguishable and thus considered as one species. The earlier discussed evidence of recent speciation would render unlikely, but not rule out entirely, yet another hypothesis: that we are dealing with non-plastic relic species. It is obvious that much more can be learned when further collections (especially at varying altitudes) are made and analysed in the future. It would also be very worthwhile to make a more detailed study of the entire population ecology of a number of flea species, together with a study of their hosts.

ACKNOWLEDGEMENTS

Firstly, the authors wish to express their gratitude to the members of the Division of Insect Borne Diseases for their interest and cooperation in identifying the collection and to Mr. F. G. A. M. Smit of the Zoological Museum, Tring for his help with the identification of some "problems". The authors wish to thank Dr. Malcolm J. Coe for his able leadership of the Mt. Kenya Expedition which guaranteed their safe return to more friendly climes, and thus made the preparation of this paper possible.

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(*Received 30th January, 1968*)

NATURE NOTE

Singing by the Chiff-Chaff in Kenya

I refer to the record of singing by a Chiff-Chaff (*Phylloscopus collybita vieillot*) on Lengetia Farm, Mau Narok, by Sessions (*J. E. Afr. Nat. Hist. Soc.* XXVI No. 1 (113): p. 40). It is worth noting that, as recorded (*Ibis* 1945: p. 94), on Mount Elgon at 12,000 feet on 9th February 1941, I heard the song of a Chiff-Chaff many times over, and later saw individuals of a *Phylloscopus* in the vicinity, presumably *P. collybita*. I was at this time living at Eldoret, and during a week-end had made a partial ascent of the southeastern slopes of Mt. Elgon, I was already familiar with the song of this species in England, where I had last heard it in the spring of 1939.

30th October, 1967.

C. W. BENSON,
Dept. of Zoology,
Downing Street,
Cambridge.

BOOK REVIEWS

The part of the *Flora of Tropical East Africa* dealing with the Caesalpinioideae has at last appeared. This group of plants is represented in East Africa by forty genera, mostly trees and shrubs with a few lianes and climbers. A section of the genus *Cassia* consists of herbs and *Cryptosepalum maraviense*, is suffrutescent with a thickened woody rhizomatose rootstock producing tufted erect annual stems.

Many are worth a place in a garden on account of their very showy flowers, usually yellow, the most ornamental being *Gigasiphon macrosiphon* which has a discontinuous distribution including Mrima Hill and Msambweni in Kenya, the East Usambaras and the Ronda Plateau in Tanzania. It is a deciduous tree up to 70ft. tall occurring in forest. Another is *Paramacrolobium coeruleum* with bluish-mauve flowers. This is recorded in East Africa from the Kwale District in Kenya and the Uzaramo District in Tanzania. Outside East Africa it is found in the Republics of Guinee, Camaroun, Congo and in the Central Africa Republic as well as Sierra Leone.

To those with a preconceived idea that the Family Leguminosae consists of plants, mostly herbs, with pinnate leaves butterfly-like flowers and dehiscent pods called legumes, the subfamily Caesalpinioideae is full of surprises. It has genera with simple leaves, *Gigiosiphon*, *Zenkerella*, *Baphiopsis*, *Tylosema*, *Bauhinia* and *Pilostigma*, and others with bipinnate leaves, *Erythrophleum*, *Burkea*, *Bussea*, *Caesalpinia*, *Parkinsonia*, *Delonix*. *Pterolobium* and *Mezoneuron*. Some genera are spiny or armed with prickles, *Pterolobium*, *Mezoneuron*, *Caesalpinia* and *Parkinsonia*, and the leaflets of some genera have pellucid gland dots, to be found in *Daniellia*, *Guibourtia*, *Oxystigma*, *Tessmannia* and *Trachylobium*.

To add further to the confusion the fruits of some genera are anything but legumes. They can be sausage-shaped like (*Swartzia* and *Tamarindus*) or long, woody and cylindrical as found as in some species of *Cassia* whilst other genera have dehiscent pods. Genera with woody dehiscent pods include *Isoberlinia*, *Berlinia*, *Julbernardia*, *Paramacrolobium* and *Brachystegia*, the fruits of some of which dehisce with a loud explosive sound, scattering their flat round seeds considerable distances. *Afzelia* has a thick woody pod which opens into two thick valves exposing up to 12 large oblong-ellipsoid black seeds each with a cup-shaped orange, red or vermilion basal aral.

The liane *Pterolobium* is very exceptional as its bright scarlet "pods" have a solitary wing not unlike the samara of a sycamore, whilst the Gum Copel Tree, *Trachylobium verrucosum* has an ovoid-oblong to obovoid indehiscent thick woody pod which is covered thickly with resinous warts.

Three other genera are also unusual, *Cordyla* and *Mildbraediodendron* with very large plum-like indehiscent so-called pods, and *Dialum* with small cherry-like indehiscent globose "pods" containing a pulpy mealy mesocarp which is brown, orange or red when dry and in which 1–2 small seeds are imbedded.

The 52 figures illustrate most of the 40 East African genera which compose this curious sub-family of the Leguminosaeae and the author, J.P.M. Brenan, is to be congratulated on a very excellent and painstaking piece of botanical research.

The Caesalpinioideae contains timbers, resinous, edible, poisonous and medicinal species, some of which are of economic importance and the genus *Brachystegia* of which there are fourteen species, these forming the dominant feature of the extensive woodlands over much of Tanzania. Published under the Authority of the Minister for Overseas Development by the Crown Agents for the Overseas Governments and Administrations. The Government Bookshop, P.O. Box 569, London, E.C. 1., price £1.8.0. Also from the Government Printers, Nairobi, Dar es Salaam and Entebbe, of the three East African Governments. Pp. 1–230 and 52 text figures with keys to the genera and their species, and a 5p. index.

A further part of the *Flora of Tropical East Africa*, the Cucurbitaceae, is now out. It is by Mr. C. Jeffrey who says it is a panatropical family of about 500 species, poorly represented in the temperate regions.

Twenty-eight genera containing a hundred and twenty seven species are represented in our region. They are woody or herbaceous, mostly with climbing or trailing stems bearing tendrils, rarely without, some have tuberous rootstocks. The flowers are usually unisexual, monoecious or dioecious, axillary and variously arranged but the female flowers are more commonly solitary than those of the male flowers.

The fruit may be a dry or fleshy capsule, berry or a hard-shelled pepo, indehiscent or dehiscent by valves, or shed their seeds by means of a lid in the fruit, by slits or apical pores, or irregularly, or rarely samaroid.

The author has designed the key to the genera so as to be of use even if only the male or female flowers or ripe fruits are available, and also to cover the atypical leafless states, at the same time the author makes it clear that some of the species are not completely known.

Of these there are eleven genera containing twenty species that are insufficiently known to be able to describe them fully, or the type specimens are no longer available for examination.

The Cucurbitaceae contains one hundred and fifty-six pages, six of them covering the index. There are twenty pages of line drawings of figures of most of the genera described; these should be of assistance to any one wanting to name a Curcurbit.

The genera and species are not easy to identify because their leaves are very variable, you often do not get the male and female flowers in flower on a plant at the same time, nor do you often get ripe fruits at the same time; if you do they may be very fleshy or so large as to make them difficult to collect.

The author is to be congratulated on the results of his study of the very difficult family Cucurbitaceae. It is a family of economic importance, having edible fruits and seeds as well as fibrous fruits and gourds for carrying liquids.

Flora of Tropical East Africa, Cucurbitaceae; published under the Authority of the Minister for Overseas Development by the Crown Agents for Overseas Governments and Administrations, price Shs. 18/- from the Government Bookshop, P.O. Box 569, London, S.E. 1. and from the Government Printers, Nairobi, Dar es Salaam and Entebbe, of the three East African Governments. Pp. 1–155 and 26 text figures with keys to the genera and their species, and a 6p. index.

Towards the end of January 1968 eight further parts of the *Flora of Tropical East Africa* were published by the Crown Agents under the Authority of the Minister for

Overseas Development. The families in this series are the Aralaceae by G. R. Tennant, price Shs. 3/25, Basellaceae by B. Verdcourt, Shs. 1/-, Cactaceae by D. R. Hunt, Shs. 1/50, Malphighiaceae by E. Lannert, Shs. 3/50, Olacaceae, Shs. 2/50 and Opiliaceae, Shs. 1/50 both by G. Ll. Lucas, Salvadoraceae by B. Verdcourt, Shs. 1/75 and the Sonneratiaceae by G. R. Williams Sangai, Shs. 1/-.

Most of these are only small families and therefore the booklets only contain a few pages, the largest being Malpighiaceae with six genera and nineteen species, the Olacaceae with six genera and ten species, followed by the Aralaceae with three genera and twenty species, the Salvadoraceae with three genera and four species, one of which is *Salvadora* with one species split into four varieties.

The Cactaceae, a family of importance from the plant pest point of view, contains only one indigenous genus, *Rhipsalis baccifera*, usually found as a succulent pendulous epiphytic shrub on trees, but which is seen sometimes as a terrestrial shrub. The other member of the family is the Prickly Pear, *Opuntia;* these are natives of the Americas and have become widely naturalized; they are pests in some countries. I do not think we know all we should know about the distribution of *Opuntia* and its species in our region and Mr. D. R. Hunt, the author, has done the best he could with the material of the genus available for him to study, as only five species are dealt with.

Any large plant of the cactus-kind with its very succulent stems and "leaves", often very bulky and covered with stiff spines or prickles, cannot be described as the ideal of a botanical specimen for a collector. They are very difficult to deal with, take up a vast amount of space in a press, usually take a long time to dry, even if they do not go mouldy and rot before they are dry, and the end product looks like something that has been brought in by the dog. As a result any specimen of this genus is strictly avoided by all botanical collectors; on this account the genus and other plants like it are very poorly represented in herbaria.

The families Basellaceae and Sonneratiaceae have only one genus each, the former *Basella* with two species; one of them, *Basella alba*, is an important spinach-like vegetable. *Sonneratia alba* in the Sonneratiaceae is a common outer-fringe constituent of mangrove swamps down the East African coast and is easily distinguished from other mangroves by its stout conical finger-like pneumatophores and by its opposite, obovate or oval, leathery yellow-green leaves.

These eight parts are well illustrated with full page line drawings showing full botanical details of the plants drawn.

Like other parts of this Flora they can be obtained from the Government Bookshop, P.O. Box 569, London, S.E. 1. or from the Government Printers, Nairobi, Dar es Salaam and Entebbe, of the three East African Governments.

P. J. G.

Flora of Tropical East Africa. Edited by E. Milne-Redhead and R. M. Polhill. *Orchidaceae* (Part 1) by V. S. Summerhayes, O.B.E., B.Sc., F.R.H.S. 1968.

Published by the Crown Agents for Oversea Governments and Administrations. Available from Government Printers in Nairobi, Kampala and Dar-es-Salaam. 236 pages, 41 line drawings. Price 28/-.

The *Orchidaceae* is probably one of the most eagerly awaited families to be produced in the F.T.E.A. series. Being a large family, with perhaps over a thousand species in the area covered by the flora, it will be issued in three parts; the first of these became available at the end of 1968. Part 2 is scheduled to be completed by the end of 1970 and Part 3 by the end of 1974. As in other families in this series the aim is to present as complete a picture as possible of the species in the area. For this reason a large amount of revision has been, and will be, necessary in certain genera, which may involve delays in publication, but the accurate and carefully produced result will be well worth waiting for.

Part 1 contains a diagnosis of the family *Orchidaceae*, a key to the tribes occurring in Tropical East Africa, and a detailed study of the tribe *Orchidae*. Seventeen genera are described and there are keys to and details of about 250 species. A reference to the type material and description, together with references to other publications concerning each species precedes a careful description. This is followed by details of cited specimens examined by the author, a note on the distribution and habitat, and concludes with a list of known synonyms for each species. There is a page of carefully executed line drawings of at least one species in each genus, and in the larger genera, such as *Habenaria*, there is a drawing of one representative of each section.

The tribe *Orchideae* contains the following genera which occur in Kenya: *Holothrix Brachycorythis*, *Cynorkis*, *Habenaria*, *Bonatea*, *Platycoryne*, *Roeperocharis*, *Disa*, *Brownleea*, *Satryrium and Disperis*. These genera are also represented in Uganda, with the exception of *Roeperocharis* and *Brownleea*. In addition species of *Neobolusia*, *Schwatzkopffia*, *Schizochilus*, *Stenoglottis*, *Centrostigma* and *Pterygodium*, which occur in southern Tanzania, are found in this book. Most of the other ground orchids, together with the large epiphytic genera *Polystachya* and *Bulbophyllum* and a few others, will appear in Part 2, and we shall have to wait for Part 3 for the tribe *Vandeae* (*Eulophia* and all the epiphytes in the angraecoid group).

I have used this part of the *Orchidaceae* for routine identifications of orchids sent in from Kenya, Tanzania, Rwanda and Burundi since it was published and have found it invaluable. Difficulties arise from time to time in interpreting the keys, when one is required to know details of the leaves and vegetative shoots of the plants. This is not the fault of the key. It is entirely reasonable that simple vegetative characters, such as the number of leaves and their position on the stem, should be used in the construction of an artificial key to species. Unfortunately many collectors (and growers) of orchids seem to think that the flowers, or at times a single flower, will suffice for identification. It often does, but the task would be much easier if a complete specimen could be submitted, or at least an adequate description of the parts which are missing could be sent in with the material.

The preparation of this work has involved many years of detailed and critical study. Botanists, naturalists and orchid collectors in East Africa will be grateful to Mr. Summerhayes for many years to come.

J. S.

C.J.P. Ionides

An Appreciation

"Iodine", as he was fondly known to his friends, came to East Africa to join the Game Department in what was then Tanganyika Territory. Before that he had been an Army Officer in India.

He chose the profession of a member of the Game Department solely because of his intense love of all forms of animal life, and it was not long before his main interest shifted from mammals to snakes and other reptiles. Nevertheless, almost to the end, he remained specially interested in collecting any specimen of the rarer animals. These he collected not simply as trophies to hang on his walls, but for their scientific interest. In fact he never built up a personal trophy collection, but he loved to feel that he had personally collected and made an important contribution for some museum or institution; and that it was the best that could possibly be obtained.

It was because of this particular facet of his life that we first got to know him, at what was then the Coryndon Memorial Museum. Shortly after the second World War onwards, until his untimely death, he collected many excellent specimens, which now form the basis of important habitat groups.

It was he who, at his own expense, mounted an expedition to the Congo to get the Mountain Gorilla. It was he who obtained for us the Yellow-backed Duiker. It was he who made the difficult journey to the Southern Sudan and brought back the skin and skeleton of the White Rhino. It was he who obtained for us the Abbott's Duiker specimen.

In more recent years, he gave an increasing amount of his time to collecting snakes, and after he had retired from the Game Department, Tanzania, he lived at Nuala in South Tanzania, and used that as a base for his reptile collecting.

In this field too, the National Museum in Nairobi owes an immense amount to him, in particular for the magnificent Water Cobra from Lake Tanganyika, and a number of other rare snakes.

He was never happy unless he was doing something in connection with wild life, and one of his most recent exploits was to go with Jonathon Leakey to Thailand, where, between them, they collected and brought back sixteen live King Cobras.

Because of his inborn shyness, Ionides made fewer friends than might have been expected, but those who knew him well, found him one of the most charming, kindly and helpful persons they had ever met. He cared little, himself, for creature comforts, but was always willing to give a hand and help anyone in any way. He was exceedingly generous to those whom he liked and who respected him.

"Iodine" never married and so leaves no family to follow his trail. It was not because he disliked women or did not enjoy their company, but simply that he felt that no woman could ever really fit into the sort of life he had chosen for himself. Perhaps he was right; nevertheless, he would have made a kindly husband and an understanding father.

The world in general, and East Africa in particular, have lost much through his passing on.

L. S. B. L.

JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. XXVII No. 3 (118) JANUARY, 1969

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(Published 31/1/69)

Price Shs. 25/-

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Nomenclature. Where a recent standard work for the area is available (e.g. Praed and Grant for birds) the names given there (both English and scientific) should be used. Initial capitals should be used for specific English names, e.g. Pied Wagtail and small initial letters for group names, e.g. wagtails. Scientific names must always be underlined and followed by the naming authority when mentioned for the first time. Where an English name is used, it must, on first mention be accompanied by the scientific name.

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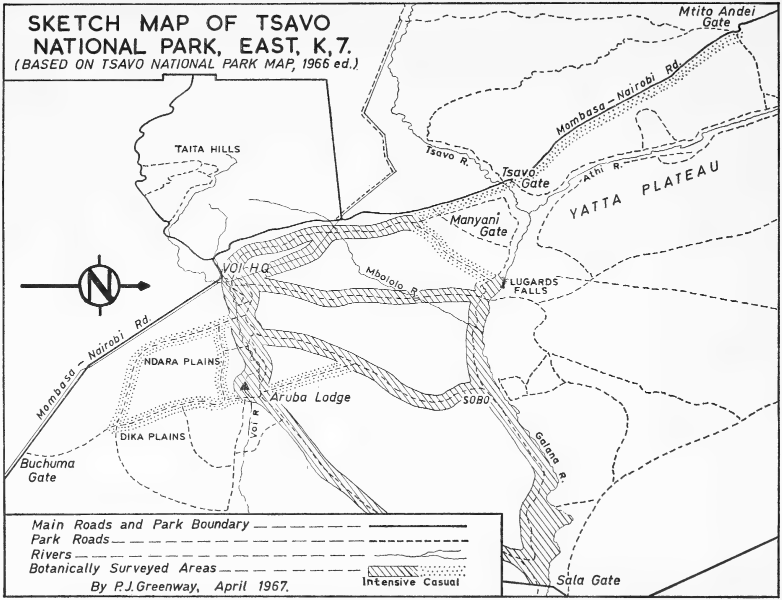
SKETCH MAP OF TSAVO
NATIONAL PARK, EAST, K, 7.
(BASED ON TSAVO NATIONAL PARK MAP, 1966 ed.)
TAITA HILLS
Mtito Andei Gate
Mombasa – Nairobi Rd.
Tsavo R.
Tsavo Gate
Athi R.
YATTA PLATEAU
Manyani Gate
VOI H.Q.
Mbololo R.
LUGARDS FALLS
N
NDARA PLAINS
Aruba Lodge
SOBO
Voi R.
DIKA PLAINS
Galana R.
Buchuma Gate
Sala Gate
Main Roads and Park Boundary
Park Roads
Rivers
Botanically Surveyed Areas
Intensive Casual
By P.J. Greenway, April 1967.

A CHECK LIST OF PLANTS RECORDED IN TSAVO NATIONAL PARK, EAST

By

P. J. Greenway

INTRODUCTION

A preliminary list of the vascular plants of the Tsavo National Park, Kenya, was prepared by Mr. J. B. Gillett and Dr. D. Wood of the East African Herbarium during 1966. This I found most useful during a two month vegetation survey of Tsavo, East, which I was asked to undertake by the Director of Kenya National Parks, Mr. P. M. Olindo, during "the short rains", December-January 1966–1967.

Mr. Gillett's list covered both the East and West Tsavo National Parks which are considered by the Trustees of the Kenya National Parks as quite separate entities, each with its own Warden in Charge, their separate staffs and organisations.

As a result of my two months' field work I decided to prepare a Check List of the plants of the Tsavo National Park, East, based on the botanical material collected during the survey and a thorough search through the East African Herbarium for specimens which had been collected previously in Tsavo East or the immediate adjacent areas. This search was started in May, carried out intermittently on account of other work, and was completed in September 1967.

BOTANICAL COLLECTORS

The first traveller to have collected in the area of what is now the Tsavo National Park, East, was J. M. Hildebrandt who in January 1877 began his journey from Mombasa towards Mount Kenya. He explored Ndara and the Ndei hills in the Taita district, and reached Kitui in the Ukamba district, where he spent three months, returning to Mombasa and Zanzibar in August.

Next the famous geologist and explorer J. W. Gregory collected in our area during January to March 1893 reaching Mtito Andei on the 23rd March on his journey to the Rift Valley.

Then in November 1893, G. F. Scott Elliott began his journey from Mombasa to Ruwenzori collecting plants on his way. Another collector, T. Kassner, passed through our area on his way from Mombasa to Nairobi in the first half of 1902 and again in 1909.

The next collector seems to have been a member of the Agricultural Department, J. MacDonald who obtained a few plants near Voi in 1924. Then between April and June 1931 Miss E. R. Napier, one time botanist of the Coryndon Museum, worked around Voi, and along the roads Voi to Taveta and Voi to Tsavo. It was she who first found a *Moringa* which is new to science and has still to be described and named.

Another lady, Miss J. Ossent, working for a firm of contractors making the pipes for the Mzima Springs-Mombasa pipe line, was stationed at Voi in 1955 and 1956 and by her collections of plants around Voi and along the Mombasa-Nairobi Road between Voi and Mtito Andei increased our knowledge of the flora of Tsavo East.

From that period until the present, a whole series of collectors, mostly passing through have collected sporadically between Mtito Andei and Mackinnon Road along the Nairobi-Mombasa Road. Among the many, have been C. G. Macarthur of the Game Department, P.R.O. Bally, botanist of the Coryndon Museum, A. Bogdan, Pasture Research Officer, Agricultural Department, B. Verdcourt of the E. A. Herbarium, Drummond and Hemsley of the Royal Botanic Gardens, Kew, R. Polhill of Kew with Samuel Paulo Kibuwa of the E. A. Herbarium and myself and others in passing when they saw a plant in flower which attracted their attention.

Of residents in Tsavo National Park, East, the Chief Warden, D. L. W. Sheldrick and others such as P. Napier Bax, C. Moore and R. Schenkel have been particularly active in collecting plants that are eaten by elephants, rhino and other game animals.

Recently Mr. and Mrs. P. Hucks, by collecting and photograping the plants in Tsavo East have contributed greatly to our knowledge of the flora. They camped at Voi within the Park and travelled almost daily over several months in search of plants in flower, to photograph in colour, pressing and drying the plant photographed so that the photo is supported by a voucher specimen. To date they have collected over 1,100 specimens and a duplicate of most are deposited in the E. A. Herbarium as well as at the Voi Headquarters of the Tsavo National Park, East.

During my stay at Voi in December and January with the the help of my field assistant, Mr. Kanuri Kabuie, we collected over 450 numbers of plants in sets of five which have been named and a set of each deposited in the E. A. Herbarium, Nairobi, the Voi Headquarters of Tsavo East, the Royal Botanic Gardens, Kew and elsewhere. This collection has added considerably to the Cyperaceae and Gramineae as well as to other genera recorded in Tsavo East.

The collection of botanical material continues by Dr. A. D. Q. Agnew and others with the aid of students of the University College, Nairobi, and the results of their finds are quoted from time to time in the Check List and I acknowledge with grateful thanks the help and comments of Dr. Agnew who has read through the List.

In spite of all this collecting activity a great deal more is necessary before we can say that the flora of Tsavo East is well known. Most of the collecting has been done along the roads and tracks between the Galana River and the Park boundary of the Nairobi-Mombasa Road. More is necessary in the north-west from Manyani-Lugard's Falls Road up to Mtito Andei. Again the area in the south-east, Ndara-Dika Plains-Aruba Lodge-Buchuma Gate-Mackinnon Road, the south of the Aruba Lodge-Sala Gate Road and the Eastern boundary from Mackinnon Road down to the Sala Gate has hardly been touched.

Thence northwards from the right bank of the Galana and the Athi rivers to the north-east, north and north-west boundaries including the Yatta Plateau is for all practical purposes botanically almost unknown. Myself, I have not been in this area of the Park because during my December-January visit these areas were so dry that the rangers in the Northern Area Headquarters had to be withdrawn as the water supplies had dried up.

THE VEGETATION

If one examines the Ordanance Survey 1:250,000 maps covering Tsavo National Park, East, the vegetation is indicated by the wording "Bush" or "Thicket" to which the words "Dense", "Medium", "Light" or "Scattered" are prefixed, sometimes "Bush and Scattered Trees", but there are no indications of Grassland. In places there are blue lines or broken-line stipples, particularly in drainage lines and river courses, the solid lines indicating "Marsh" and the broken ones "Marsh, seasonal". Most of these "Marsh" areas lie in the northern portion of the Park, an area I have not seen. They may be Flood Plains Grassland or even Riverine Forest as between the Park Air Strip and the 1,600ft. contour line along the Voi River.

The main vegetation types met within the area southwards of the Athi-Galana Rivers to the southern side of the Park bounded by the Nairobi-Mombasa Road from Manyani Gate to Voi thence the Voi Gate-Ndara Circuit by way of Aruba Lodge down to the Sala Gate in the east are as follows:

1 Forest.

(a) Ground-water Forest:

Fringing or riverine forest: Swamp Forest

Palm Stands.

2 Woodland.
3 Wooded Grassland.
 (a) Grouped-tree grassland.
 (b) Scattered-tree grassland.
 (c) Shrub or Dwarf tree grassland.
4 Grassland.
 The Galana River Grass Fringe.
5 Swamp Vegetation.
6 Bushland.
 (a) Ever-green Bushland.
 (b) Thicket.
 Ever-green thicket.
7 Vegetation of Rocky Hills and Rock Pavements.

1 Forest.

(a) *Ground-water Forest.*

The greater part of this is Riverine Forest with a very limited amount of Swamp Forest. In Tsavo East the riverine forest consists of a continuous stand of trees which attain a height of 60ft. (c.18m.) with crowns touching or intermingling, sometimes freely interlaced with lianes. The canopy is not very dense nor does it consist of several distinct layers. Epiphytes such as orchids and ferns are not evident. The trees have simple or buttressed boles and some of them are in full leaf all the year round. The forest floor is covered with herbs and shrubs where the light penetrates.

The Riverine Forest and Swamp Forest can be observed along the banks of the Voi and Galana Rivers. That along the Voi River consists of small stands of Fresh-water Swamp Forest near the Voi-Mombasa Road which thins out soon after passing Ndololo and then becomes a very thin and broken strip on both banks of the river of Fringing Forest. Its chief components are:

Trees:

Frequent, *Dobera glabra*, *Newtonia hildebrandtii* var. *hildebrandtii*.

Common, *Acacia* sp., *Kigelia africana*.

Occasional, *Albizia glaberrima* var. *glabrescens*, *A. zimmermannii*, *Ficus ingens*, *F. sycomorus*, *Tamarindus indica* and *Terminalia kilimandscharica*.

Shrubs:

Frequent, *Azima tetracantha*, *Capparis sepiaria* var. *fischeri*, *Pluchea dioscoridis*, *P. ovalis*, *Salvadora persica*, and *Combretum ukambensis*, locally frequent.

Common, *Cordia goetzei*, *Gardenia jovis-tonantis*, *Lawsonia inermis*, *Vernonia hildebrandtii*, with *Lecaniodiscus fraxinifolius* and *Meyna tetraphylla* locally common, and *Ziziphus mucronata*, rare.

On the Galana River the fringing forest is of quite a different composition, the fringe of trees thinner and confined strictly to the immediate banks of the river, although it is said to have been denser until the great floods of 1961.

Here in the riverine forest you have two sub-types, Palm Stands of *Hyphaena coriacea*, consisting of a thin line of branched palms up to 50ft. (c.15m.) tall.

Then from place to place down the river there are extensive stands of Ever-green Bushland composed of open to closed stands of a very succulent leaved shrub, *Suaeda monoica*, up to 20 or more feet tall (c.6m.) which forms an exclusive dominant and is an indicator of a saline soil.

The Riverine fringe trees are *Acacia elatior* ssp. *elatior*, common, looking very decrepit. *Populus ilicifolius* in small dense stands of all age grades from juveniles about 1ft. (c.30cm.) high to vigorous trees up to about 30ft. (c.9m.) tall, the older more mature ones very few and far between because most of them swept away by the floods. *Tamarindus indica* and *Adansonia digitata*, infrequent.

Other trees, mostly rare were *Spirostachys africana* (G. & K. 12, 923; 13,011) or *Excoecaria venifera; Cordia goetzei*, *Garcinia livingstonei*, *Mimusops fruticosa* with the lianes *Ampelocissus africana*, *Cordia* sp. nov. (G. & K. 13,053) and a Menispermaceae, *Tiliacora* or *Triclisia* sp. (G. & K. 13,054).

2 Woodland.

This consists of land covered with an open cover of trees, their crowns not forming a thickly interlaced canopy, which are leafless for some periods of the year. Scattered evergreen shrubs are present but not conspicuous. Grasses and herbs form the dominant ground cover and consist of perennial and annual species, the former, usually with a tufted habit of growth rarely above 3ft. (30.5cm.) tall.

This is not extensive in this part of Tsavo East and has no doubt been considerably reduced by the activities of elephants and by fire. Judging by examples adjacent to the Park its dominants are *Commiphora-Lannea-Boswellia* with three species of *Sterculia*, *S. africana*, *S. rhynchocarpa*, and *S. stenocarpa*, these are impossible to identify specifically unless they are in fruit. Other associated trees are *Cassia abbreviata* ssp. *kaessneri*, *Delonix elata*, *Platycelyphium voense*, *Melia volkensii*, *Acacia tortilis* ssp. *spirocarpa*, *A. reficiens* ssp. *misera* and *A. thomasii* with *Adansonia digitata* as an occasional emergent.

When good examples are met with their canopy is generally from 20–25ft. (c.6–8m.) tall or sometimes 30ft. (c.9m.) with an open ground cover of bushes mainly Acanthaceae, *Grewia villosa*, some Labiates such as *Erythrochlamys spectabilis* and an assortment of interesting *Euphorbia* spp. Such grasses as are present are ephemerals such as *Aristida* spp., *Brachiaria eruciformis*, *B. leersioides* or wide spaced perennials such as *Cenchrus ciliaris*, *Chloris roxburghiana* and *Schmidtia bulbosa* with stands of *Eragrostis caespitosa* in areas of impeded drainage on bright red soils. Climbers such as *Pergularia daemia*, *Gerrardanthus lobatus*, *Kedrostris gijef*, *Ipomoea* spp. and *Thunbergia guerkeana* are frequent.

3 Wooded Grassland.

This is land covered usually by perennial grasses and other herbs, with either evergreen or deciduous, grouped or scattered, armed or unarmed, trees and shrubs, that cover less that than 50% of the ground. The grasses dominate the aspect though the trees and shrubs are always conspicuous, the former may be densely procumbent or matted, or may grow in patches, tufts or clumps attaining a height of 4ft. (c.121cm.) rarely more. They may completely cover the surface of the ground or be thinly scattered so that the soil is easily visible between the grass clumps or mats.

There are three types:—a, Grouped-trees Grassland, b, Scattered-trees Grassland and c, Shrub or Dwarf-trees Grassland to be seen in Tsavo East, but, the most widely distributed are the Scattered-trees and the Shrub or Dwaft-trees Grasslands.

(a) *Grouped-trees Grassland.*

This may contain stands of *Acacia* spp., *Melia volkensii*, *Delonix elata*, *Commiphora* spp., *Dobera glabra* and *Platycelyphium voense*. The grasses being *Chloris roxburghiana*, *Cenchrus ciliaris*, *Sporobolus helvolus*, *Cynodon dactylon*, *Digitaria* spp. not infrequently *D. macroblephara* and *Schmidtia bulbosa*.

Scattered-trees Grassland and Shrub or Dwarf-trees Grassland merge into one another and are not easy to delimit. Their more open phase deteriorates into Grassland as a result of the activities of elephants or of grass fires.

(b) *Scattered-trees Grassland.*

In this type the trees can be *Melia volkensii-Platycelyphium voense-Commiphora* spp. with a very occasional *Euphorbia robecchii* or *Adansonia digitata* with a similar composition of grass species to those found in the Grouped-trees Grassland.

(c) *Shrub or Dwarf-trees Grassland.*

This type is widespread, its woody components being *Boscia coriacea* which is found throughout Tsavo East, *Dobera glabra* frequent, *Balanites orbicularis*, rare, *Cadaba heterotricha*, *Terminalia parvula*, *T. spinosa*, *Platycelyphium voense* and *Commiphora* spp. with the ubiquitous shrubs *Sericocomopsis hildebrandtii* and *Premna resinosa*. Other shrubs to be met with in this type are shrubby Acanthaceae, *Maerua* spp., *Thylachium thomasii*, *Calyptrotheca somalensis*, *C. taitensis*, *Cordia ovalis*, *C. gharaf*, *Ehretia teitensis*, *Premna hildebrandtii*, *P. holstii* and the common *Combretum aculeatum*.

4 Grassland.

This is land covered with grasses and other herbs generally perennial, sometimes with evergreen or deciduous trees or shrubs, either very scattered or in small isolated groups, in either case not covering more than 10% of the ground. The grasses may be procumbent or mat-like, forming a dense or thin carpet on the ground or in clumps or tussocks, close or widely spaced or they may be perennial forming a continuous ground cover. They may be from a few inches tall to about 4ft. (c.121cm.) rarely more.

There is hardly any true grassland in Tsavo East that is without any trees or shrubs in its composition. An example is to be seen in the Ndara-Dika Plains area. This had been burnt so it was impossible to tell what species of grass it was composed of at the time of my visit.

Along the Pipe-line Road from Worssera Hill towards Irima there is a fairly extensive stand of grassland which originally contained islands of trees or bush groups, now only relics of *Acacia bussei-Cadaba heterotricha-Combretum aculeatum* on a black cracking clay with grey sand-washes from the slopes of the nearby hills. The grasses collected and noted in this area were:—*Brachiaria deflexa*, *B. leersioides*, *Brachiaria* sp. G. & K. 12,717; *Cenchrus ciliaris*, *Digitaria macroblephara*, *D. rivae*, *Ischaemum afrum*, *Latipes senegalensis*, *Leptochloa obtusiflora*, *Panicum infestum*, *P. maximum* and *Schoenfeldia transiens*. It formed an open to closed ground cover with scattered *Cyperus obtusiflorus* and *C. giolii*, the latter, a bulbous based annual, was common on the margins of the road. Other herbs were also present.

A further example, but in a very open bushland can be seen along the Sobo-Aruba Lodge Road on a low ridge composed of a pale buff sandy and stony loam. The grasses together with the woody vegetation formed a very open cover and the ground between was visible between the different species.

The grasses were *Aristida adscensionis*, *A. barbicollis*, *Cenchrus ciliaris*, *Chloris roxburghiana*, *Chrysopogon aucheri* var. *quinqueplumis*, *Cymbopogon pospischilii*, *Digitaria pennata*, *D. rivae*, *Enneapogon elegans*, *Latipes senegalensis*, *Tetrapogon tenellus* and the rare *Tetrachaete elionuroides* was common on the sides of the road as well as being scattered in the more open parts of the grass cover.

The more important components of the woody vegetation were *Commiphora* spp., *Terminalia orbicularis*, *Boscia coriacea*, *Acacia tortilis* ssp. *spirocarpa*, *Caesalpinia trothae*, *Caucanthus albidus*, *Cassia longiracemosa*, *Ehretia teitensis* and *Thylachium thomasii*.

The Galana River Grass Fringe.

The Galana River varies greatly in volume as a result of up-country rains; in the very high floods of 1961 great damage was done to its riverine fringes, the water spreading well beyond the banks. At the height of the dry season it is extremely shallow and it is possible to cross from bank to bank in most places without difficulty.

In the riverine fringe the Cyperaceae are represented by three genera and nine species; they are:— *Cyperus articulatus*, aquatic, frequent; *C. alternifolius* ssp. *flabelliformis*, semi-aquatic, common ; *C. compressus*, semi-aquatic on sand banks; on sand banks, *C. longus* ssp. *tenuiflorus*, locally common and *C. maculatus*, uncommon,

Fimbristylis bis-umbellatus and *Lipocarpus chinensis*, rare; *Cyperus immensus* var. *taylori*, local and *C. laevigatus* very local. All on the left bank of the Galana.

The Gramineae, eighteen genera with twenty-three species are also recorded from the left bank and the following are represented: Aquatic, *Diplachne caudata*, local. Semi-aquatic, *Panicum repens*, *Paspalidium geminatum*, both locally dominant, the latter on sand banks; *Hemarthria natans* and *Leersia hexandra*, locally common ; *Phragmites mauritiana*, common. Sandbanks, *Aristida adscensionis*, *A. papposa*, *Eragrostis horizontalis*, common; *Chloris barbatus* and *Panicum meyerianum* local; *Eragrostis exasperata*, *E. superba*, *Hyparrhenia filipendula* var. *pilosa* and *Perotis patens* rare. *Cynodon dactylon*, frequently dominant, *Paspalum vaginatum*, locally dominant, *Heteropogon contortus*, locally common and *Cenchrus setigerus* and *Schmidtia bulbosa* both local; *Phragmites karka* and *Sporobolus virginicus* rare. On rocks, *Sporobolus* sp. G. & K. 13,073, local and *Eulalia* sp. aff. *E. ferruginea* G. & K. 12,920, rare. Of the above species *Cyperus laevigatus*, *Diplachne caudata*, *Paspalum vaginatum* and *Sporobolus virginicus* are saline-alkaline indicators.

5 Swamp Vegetation.

This type can be Permanent Swamp, or Seasonal Swamp Grassland, the former in the southern area of Tsavo East and to be seen on the south bank of the Voi River where it would be classed as Ground-water Forest and is not within the bounds of Tsavo East.

Seasonal Swamp Grassland is a flat area where free water accumulates on the surface for some periods of the year or which can be temporarily flooded to a shallow depth. The land could be covered with trees when it would be classed as Ground-water Forest or with herbaceous vegetation, the chief components being grasses, rushes, sedges and aquatic plants.

The chief areas of interest in Tsavo East are the Kandiri Lake and the Aruba Dam where there is permanent water. Also water-holes, widely scattered, and wallows, most of these of a seasonal nature.

It is apparent that Kandiri Lake on the Voi Gate-Aruba Lodge Road was originally an old ox-bow of the Voi River, but has been further deepened and enlarged by the the Park authorities and is fed seasonally by the river.

The lake is surrounded by much battered open bushland of *Newtonia hildebrandtii*, *Thylachium thomasii*, *Salvadora persica* and scattered bush clumps of *Ecbolium amplexicaule*, *E. revolutum*, *Maerua denhardtiorum*, *M. subcordatum* and the ubiquitous *Sericocomopsis;* the dominant grasses being *Cynodon dactylon*, *Cenchrus ciliaris* and *Bothriochloa radicans* and in much trodden bare patches the annual herbs *Alternanthera pungens*, *Euphorbia hirta*, *Tribulus*, and, uncommon *Corchorus olitorius* or *C. trilocularis*. In the water are to be found *Nymphaea capensis* as islands, rafts of *Marsilea minuta* and dominant *Najas graminea* submerged, as well as stands of *Echinochloa haploclada*, rare *Panicum* sp. nov. G. & K 12,674 and very local *Conyza aegyptiaca* var. G. & K. 12,673. With the advent of the dry season as other sources of water dry up this lake is considerably reduced by game, especially elephants and water buck using it for drinking purposes and the aquatic and surrounding vegetation much reduced by grazing, browsing and by trampling of the cover.

The Aruba Dam across the Voi River is a source of permanent water. With the alternation of the wet and dry seasons there is a considerable rise and fall in the level of the water in the dam with much exposure of a very trampled grey-black clay loam at the head of the dam where the river discharges its waters. This area, as the water recedes in the dry season is invaded by the herbs *Coldenia procumbens*, *Eclipta prostrata*, *Alternanthera sessilis* as co-dominants and scattered *Corchorus*, *Rorippa madagascariensis*, *Mollugo nudicaule* with grasses *Echinochloa haploclada* and *Sporobolus helvolus*, the latter as a fringe. Towards the river proper are the relics of clumps

of *Cyperus immensus*, much damaged through browsing and trampling by elephants and other game.

The banks of the dam itself are treeless and Cyperaceae, except for *Cyperus articulatus* as a water-side fringe, are conspicuous by their absence. A rare bush clump of *Sesbania sericea*, heavily browsed, may be seen. The grassland fringe consists of *Cynodon dactylon*, *Paspalidium geminatum*, co-dominant with *Sporobolus helvolus* and *Echinochloa haploclada* and rare *Eragrostis aethiopica* in disturbed ground. The herbs, *Grangea maderaspatana*, annual, and *Phyla nodiflora*, perennial, will also be noticed.

Scattered water-holes and wallows may have clumps of bushes of *Lawsonia inermis*, *Ziziphus mucronata*, or single bushes of *Gardenia jovis-tonantis*, this latter seems to be indestructable by game, occasionally a *Tamarindus indica* or *Kigelia africana* tree, or rarely *Acacia stuhlmannii*. If the water rapidly evaporates or is quickly dispersed by the game drinking or wallowing the bare ground is first invaded by annuals such as *Glinus setiflorus* to be followed by the grasses *Echinochloa haploclada* or *Sporobolus helvolus*, the latter an indicator of a slightly alkaline soil. Sometimes an occasional scattering of *Cyperus distans* will also be seen with either of these two grasses.

6 Bushland.

This is land covered with more than 50% cover of shrubs or small trees growing denseley together. The trees or bushes may be evergreen or deciduous, armed or unarmed. The bushes have no clearly defined boles and may be from a few feet to 15ft. (2-5m.) tall, rarely more. Tall trees such as *Adansonia digitata*, *Delonix elata*, *Melia volkensii* and rarely *Lonchocarpus–Terminalia*, *Euphorbia robecchii*, may be present, occasionally in clumps, more often as widely scattered individuals. Herbs, ephemeral or succulent or both and grasses not above 3ft. (1m.) tall, mostly annual or short-lived perennial form the ground cover under deciduous bushland.

Bushland varies from place to place in the Park and is rich in species, the bulk of it is deciduous but there is (a) *Evergreen Bushland*, dominated by *Suaeda monoica* which has already been referred to under Riverine Forest and occurring along the south bank of the Galana River.

Several different communities occur in the Park, in most of them emergent trees of *Commiphora* spp.-*Delonix elata-Sterculia* spp. -*Melia volkensii* may be present.

One example studied was on a bright orange-red loam adjacent to a granite intrusion. The following shrubs or small trees were present: *Dirichletia glaucescens*, *Euphorbia engleri*, *E. scheffleri*, *Hymenodction parvifolium*, *Commiphora riparia*, *Strychnos decussata*, *Combretum aculeatum*, *Lannea alata*, *Premna resinosa*, *Boswellia hildebrandtii*, *Erythrochlamys spectabilis*, *Bauhinia taitensis*, *Terminalia orbicularis*, *Bridelia taitensis*, *Sesamothamnus rivae*, *Calyptrotheca somalensis* and *Grewia fallax*. Associated with them were the climbers *Sarcostemma viminale*, *Gerrardanthus lobatus*, *Adenia globosa*, *Thunbergia guerkeana* and *Vanilla roscheri*.

A second community, on a brown sandy clay loam, consisted of *Combretum grotei*, *C. aculeatum*, *Dobera glabra*, *Cadaba heterotricha*, *Terminalia spinosa*, *T. parvula*, *Caucanthus albidus*, *Caesalpinia trothae*, *Ehretia teitensis*, *Sericocomopsis hildebrandtii*, *Terminalia orbicularis*, *Acacia tortilis* ssp. *spirocarpa* and *Balanites orbicularis*.

A third, rather open, on a buff-brown sandy loam, contained *Acacia bussei*, *A. mellifera*, *A. nilotica* ssp. *subalata*, *A. reficiens* ssp. *misera*, *Boscia coriacea*, *Combretum aculeatum*, *Combretum* sp. aff. *C. grotei*, G. EAH. 12,204, *Commiphora africana*, *Cordia ovalis*, *Grewia tembensis* var. *kakothamnos* and *G. villosa* with *Sericocomopsis*.

(b) *Thicket*.

As here defined is a close to rather open assemblage of coppicing or virgate deciduous or evergreen bushes with or without scattered trees projecting through the

main canopy which may be from about 6 to 15ft. (3-5m.) rarely up to 25ft. (c.7m.).

Deciduous thicket, some examples observed were: *Givotia gosai*, this is a virgately branched shrub to 20ft. (7m) with several main branches from ground level. It is very locally dominant forming an open thicket with *Melia volkensii*, *Commiphora* spp. and small stands of *Platycelyphium voense* occur with it. To be seen near Irima Hill and along the Aruba-Sobo Road where it is quite extensive.

Bauhinia taitensis thicket, in small patches in open *Delonix elata-Boscia coriacea-Platycelyphium voense-Hymenodictyon parvifolium* bushland on a rich red loam. The *Bauhinia* up to about 6ft. (2m.) tall, has very attractive flowers which can be white, yellow or very pale pink.

Ochna inermis thicket, a densely branched shrub to 6ft. (2m.) tall with clusters of very fugitive yellow flowers which are followed by small glossy black fruits enveloped in a bright crimson calyx. A co-dominant with *Premna resinosa* in open to closed thicket to the right of the Pipe-line Track after passing Worsessa Look-out.

Evergreen thicket, this is composed of *Anisotes parvifolius*, a not particularly leafy shrub with green virgate stems up to about 12ft. (3m.) tall. This can be seen in various parts of Tsavo East, but the best examples are to be found down the Voi-Lugard's Falls Road towards the Mbololo River Drift, and between Voi Gate and Aruba Lodge.

7 Vegetation of Rocky Hills and Rock Pavements.

The rocky hills and rock pavements are thinly covered with trees and shrubs, quite a number of which are not found in other habitats. In the course of the survey the following hills and rocky places, Mzinga Hill, Wasessi, Irima Hill, Mudanda Rock and Sobo Rocks, were visited from time to time and the following species were noted:

Trees

Common:

Acacia tortilis ssp. *spirocarpa. Delonix elata. Euphorbia quinquecostata. Ficus populifolius*, *F. sonderi. Melia volkensii.*

Occasional:

Adansonia digitata. Albizia anthelmintica. Berchemia discolor. Commiphora sp. G. & K. 12,658 and 12,893. *Platycelyphium voense. Sterculia stenocarpa. Terminalia kilimandscharica.*

Local:

Euphorbia kibwezensis. Ficus ingens.

Rare:

Dalbergia melanoxylon. Diospyros consolata. Holarrhenia febrifuga. Lannea stuhlmannii. Sterculia africana. Vitex payos.

Shrubs

Frequent:

Boscia coriacea. Combretum aculeatum. Euphorbia scheffleri. Strychnos decussata. Tarenna graveolens.

Common:

Boswellia hildebrandtii. Boscia sp. *Bridelia taitensis. Combretum exalatum. Cordia ovalis. Dirichletia glaucescens. Euphorbia heterochroma. Grewia villosa. Haplocoelum foliolosum. Premna resinosa. Sarcostemma viminale. Thylachium thomasii. Vepris eugeniifolia.*

Locally common:

Combretum ukambensis. Dombeya praetermissa. D. umbraculifera. Euphorbia jatrophoides. E. polyantha. Ruttya fruticosa. Sacleuxia newii. Thunbergia holstii. Vellozia aequatorialis.

Occasional:

Cassia abbreviata ssp. *kaessneri. Crotalaria scassellattii. Croton dichogamus. Grewia nematopus. Strophanthus mirabilis. Vernonia wakefieldii.*

Rare:

Acacia brevispicata. Adenium obesum. Euphorbia sp. G. & K. 12,956. *Psychotria* sp. G. & K. 12,774 and 12,824. *Solanum taitensis. Strychnos* sp. G. & K. 12,660. *Tephrosia noctiflora. Tinnea aethiopica. Triaspis erlangeri.*

Lianes

Common:

Cissus quadrangularis.

Locally common:

Cardiospermum halicacabum. Cissus rotundifolius. Ipomoea bullata.

Rare:

Cissus cactiformis.

Herbs

Frequent:

Sansevieria ehrenbergiana.

Common:

Barleria prionitis. Celosia anthelmintica. Ruellia patula.

Locally common:

Amorphophallus gallaensis. Centemopsis rubra. Chlorophytum tenuifolium. Cleome stenopetala. Crossandra mucronata. Jatropha spicata. Merremia pinnata. Sansevieria singularis. Stylochiton angustifolius. Urginea sp. G. & K. 12,975 and 13,030.

Occasional:

Albuca wakefieldii. Anthericum suffructicosum. Asystasia somalensis. Barleria diffusa. Polygala amboniensis. Zornia glochidiata.

Rare:

Amaranthus angustifolium ssp. *silvester. Caralluma speciosa. Corchorus* sp. aff. *C. baldaccii* G. & K. 12,957. *Cryptostephanus haemanthoides. Drimiopsis* sp. G. & K. 12,854. *Echidnopsis* sp. nov. G. & K. 12,952. *Hybanthus danguyanus. Stemodiopsis buchananii, S. humilis.*

Grasses

Frequent:

Schmidtia bulbosa.

Common:

Brachiaria leersioides. Enteropogon macrostachyus. Panicum maximum.

Locally common:

Andropogon schinzii. Digitaria milanjiana. Tricholaena eichingeri.

Occasional:

Heteropogon contortus. Oropetium thamaeum. Rhynchelytrum villosum. Sporobolus pellucidus. Tragus berteronianus.

Rare:

Dactyloctenium sp. G. & K. 12,738. *Eragrostis ciliaris. Oropetium* sp. nov. G. & K. 12,766. *Setaria pallidifusca. Sporobolus festivus.*

Cyperaceae

Common:

Kyllinga alba.

Locally common:

Bulbostylis sp. G. & K. 12,770 and 12,949. *Fimbristylis exilis.*

Occasional:
Mariscus sp. G. & K. 12,662.

Ferns

Frequent:
Actiniopteris dimorpha.
Locally common:
Selaginella dregei.
Occasional:
Actiniopteris semiflabellata.
Rare:
Actiniopteris radiata. Pellaea adiantoides.

Lichens

Locally common:
Rocella pattensis. Teloschistes validus. Both on dead or dying trees.

THE ARRANGEMENT OF THE FAMILIES

Only two fungi have been recorded and the arrangment of these follows Clements & Shear. The two lichens follows Smith's Lichens.

For the Ferns and Fern Allies the arrangment as far as possible follows that of Copeland, E. B., Genera Filicum.

For the Flowering Plants the arrangement follows that of Hutchinson's The Families of Flowering Plants (1926 and 1934), but in each family the arrangement of the genera and species is by alphabetical sequence.

Where an account of a family has been published in 'The Flora of Tropical East Africa' the family name is followed by F.T.E.A. with the year of publication.

For botanists a taxonomic arrangement is ideal but it is quite useless to park wardens and rangers with little or no botanical knowledge and with no botanical books of reference in their park headquarters to which they can refer.

To cater for those with no botanical knowledge I have provided an index to the families and genera in the hope they will be able to find their way about in the Check List.

ACKNOWLEDGEMENTS

My thanks are due to Mr. P. M. Olindo, Director of the Kenya National Parks for giving me the opportunity to do a botanical survey of the Tsavo East National Park, and to Dr. O. Starnes, Director, E.A. Agriculture and Forestry Research Organisation, for permitting me to undertake the survey and for permission to publish the results. To Mr. D. L. W. Sheldrick, the Park Warden for help and the facilities provided and to Mr. R. Jenkins, the Assistant Park Warden. Also to Mr. J. B. Gillett, Botanist in Charge of the East African Herbarium for the loan of a Field Assistant, Mr. Kanuri, from the Herbarium, whose help enabled me to make a reasonable collection of botanical specimens considering the time of year and the condition of the vegetation in the Tsavo National Park, East.

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CRYPTOGAMAE

FUNGI

74 Polyporaceae

Polystictus versicolor Fr.
Gregory sn., not seen.

77 Lycoperdaceae

Podaxis pistillaris (Pers.) Morse
Sr. G.

LICHENES

22 Rocellaceae

Rocella pattensis Dodge
G. & K. 12,859; 12,888.

49 Teloschistaceae

Teloschistes validus (Muell. Arg.) Hillm.
G. & K. 12,851.

FERNS AND FERN ALLIES

Equisetaceae

Equisetum ramosissimum Desf.
G. & K. 13,007.

Selaginellaceae

Selaginella dregei (Presl.) Hieron.
G. 9615; G. & K. 12,654; Gillett 17,278.

6 Pteridaceae

Actiniopteris dimorpha Pic.-Serm.
G. & K. 12,656.

A. semiflabellata Pic.-Serm.
Hucks 991.

A. radiata Link.
Gregory sn., not seen.

Pellaea adiantoides (Willd.) Kaulf
G. & K. 12,822.

P. viridis (Forsk.) Prantl. (Syn. *P. hastata* Link.)
Gregory sn., not seen.

6A Adiantaceae

Adiantum incisum Forsk. (Syn. *A. caudatum* L.)
Gregory sn., not seen.

14 Aspleniaceae

Ceterach cordatum (Thunb.) Desv. (Syn. *Asplenium ceterach* L.)
Gregory sn., not seen.

Marsileaceae

Marsilea diffusa A. Br.
G. & K. 12,672.

M. minuta L.
G. & K. 13,035.

DICOTYLEDONES

I Archichlamydeae
(Families Nos. 15–213).

15 Ranunculaceae F. T. E. A. (1952).

Clematis simensis Fres. var. *dentata* O. Ktze.
Gregory sn., not seen.

18 Nymphaeaceae

Nymphaea capensis Thunb.
G. & K. 13,059.

23 **Menispermaceae** F. T. E. A. (1956).

Tiliacora sp. *or Triclisia* sp.
G. & K. 13,054.

26 **Hydnoraceae**

Hydnora abyssinica Schweinf.
Mrs. d. Jong H. 362/62; Venour H. 114/50.

H. bogosensis Beccari e desc.
Sheldrick H. 177/63.

It is recorded that both species are parasitic on the roots of *Acacia* spp., whilst *Adansonia digitata* L., is a host plant of *H. bogosensis*.

32 **Papaveraceae** F. T. E. A. (1962).

Argemone mexicana L.
Hucks 232; 889.

34 **Turneraceae** F. T. E. A. (1956).

Wormskioldia sp.
G. & K. 13,754; Verdcourt 1197.

36 **Capparidaceae** F. T. E. A. (1964).

Boscia coriacea Pax
G. & K. 12,952; 13,075

Cadaba farinosa Forsk. spp. *adenotricha* (Gilg & Ben.) R. Grah.
G. & K. 12,697.

C. heterotricha Hook.
G. & K. 12,832; Hucks 822.

C. stenopoda Gilg & Ben.
G. & K. 13,081.

C. glandulosa Forsk.
G. & K. 12,911.

C. ruspolii Gilg
G. & K. EAH. 13,702.

Capparis sepiaria L. var. *subglabra* (Oliv.) De Wolf
G. & K. 12,693; Hucks 889.

C. tomentosa Lam.
G. & K. 12,994.

Cleome briquetii Polhill
G. & K. 12,748; 12,850; Hucks 472; 537;.

C. macrophylla (Klotzsch) Briq.
Hucks 563.

C. hirta (Klotsch) Oliv.
G. & K. 12,901.

C. tenella L. f.
G. & K. 12,755.

Gynandropsis gynandra (L.) Briq. (Syn. *G. pentaphylla* DC.)
Gregory sn., not seen.

Maerua angolensis DC.
Sr. G.

M. denhardtiorum Gilg
G. & K. 13,043; Hucks 833.

M. holstii Gilg
Ossent 110.

M. macrantha Gilg
Hucks 419.

M. subcordata (Gilg) De Wolf
G. & K. 12,671; 13,080.

M. crassifolia Forsk.
Hucks 413; Ossent 66.

M. edulis (Gilg & Ben.) De Wolf
G. & K. 12,700; 13,079.

M. kirkii (Oliv.) F. White
Hucks 826; Ossent 41.

M. ? oblongifolia (Forsk.) A. Rich.
Verdcourt 1594.

M. triphylla A. Rich. var. *calophylla* (Gilg) De Wolf
Hucks 469.

Thylachium thomasii Gilg
G. & K. 12,986.

37 **Moringaceae**

Moringa sp. nov.
G. & K. 12,932; 13,087.

Moringa sp. nov.
Van Praet 71.

39 **Cruciferae**

Farsetia ? longisiliqua Decne
G. & K. 12,722.

Rorippa madagascariensis (DC.) Hara
G. & K. 13,062.

40 **Violaceae**

Hybanthus danguyanus H. Perrier
G. & K. 12,916.

H. enneaspermus (L.) F. Muell. var. *enneaspermus*
G. & K. 13,018; Hucks 1,059.

Rinorea elliptica (Oliv.) O. Ktze
G. & K. 13,018.

42 **Polygalaceae**

Polygala erioptera DC.
G. & K. 12,909.
P. liniflora Chod.
G. & K. 12,917; 12,973.
P. sphenoptera Fres.
G. & K. 12,863; Hucks 549; 1060.
Polygala sp.
Hucks 1018.
P. kilimandscharica Chod.
Napier 1008.
P. petitiana A. Rich.
Gregory sn., not seen.
Polygala sp.
G. & K. 13,069.

45 **Crassulaceae.**

Kalanchoe sp.
Hucks 1004.

54 **Aizoaceae (Ficoidaceae)** F. T. E. A. (1961).

Corbichonia decumbens (Forsk.) Exell
Hucks 651a; Sheldrick B8567.
Gisekia pharnaceoides L.
Hucks 468; 786.
Glinus setiflorus Forsk.
G. & K. 12,973; Hucks 1041; 1056.
Hypertelis bowkerana Sond.
Hucks 1068.
Limeum viscosum (J. Gay) Fenzl var. *kenyense* Friedr.
Napier 1000.
Mollugo cerviana (L.) Ser. var. *spathulifolia* Fenzl
Hucks 656; Napier 902.
M. nudicaulis Lam.
Bally B8797; Gillett 17,268.
Trianthema ceratosepala Volkens & Irmsch.
Hucks 440.
T. portulacastrum L.
Hucks 729.
Zaleya pentandra (L.) Jeffr.
Hucks 60; Napier Bax TNP/E/26.

56 **Portulacaceae**

Calyptrotheca somalensis Gilg
G. & K. 12,931.
C. taitensis (Pax & Vatke) Brenan
G. & K. 12,821.
Portulaca oleracea L.
Hucks 595; Napier 1044.
P. quadrifida L.
Hucks 724; 757.
Portulaca sp.
Napier 951a.
P. pilosa L.
Verdcourt & Polhill 2707.
Portulaca sp.
Hucks 540.
Talinum caffrum (Thunb.) Eck. & Zey.
G. &. K. 12,734.
T. portulacifolium (Forsk.) Schweinf
Hucks 218; 523; Ossent 81.

57 **Polygonaceae** F. T. E. A. (1958).

Oxygonum atriplicifolium (Meisn.) Martel.
Hucks 774; 775.
O. stuhlmannii Dammer
Hucks 27/A.
Polygonum senegalensis Meisn.
Hucks 338.

61 **Chenopodiaceae** F. T. E. A. (1954).

Chenopodium ambrosioides L.
Hucks 366.
Suaeda monoica J. F. Gmel.
G. & K. 12,647; Gregory sn., not seen.

63 **Amaranthaceae**

Achyranthes aspera L.
Williams 7; Sheldrick TNP/E/100: Hucks 1050.
Aerva lanata (L.) Juss. var *elegans* Susseng.
G. 9824; G. & K. 12,941
A. persica (Burm. f.) Merr.
Agnew et al. 7332; Hucks 57.
Alternanthera pungens H. B. K.
G. & K. 12,666
A. sessilis (L.) R. Br.
G. & K. 13,041.
Amaranthus aschersonianus Thellg.
Napier 911.
A. graecizans L.
G. & K. 12,845; Polhill & Paulo 937.
Celosia acroprosoides Hochst.
G. & K. 12,823; Hucks 793.
C. trigyna L.
Napier 995.

63 Amaranthaceas (*cont.*)

Centemopsis rubra (Lopr.) Schinz
Hucks 685; Napier Bax TNP/Gs/1.
Digera mucronata (L.) Mast.
G. & K. 12,844; Napier 906.
Gomphrena celosioides Mart.
G. & K. 12,783; Hucks 353; 1023.
Pleuropterantha sp. fide Kew
G. 9776.
Psilotrichum boivinianum Cavace
G. & K. 13,020; Hucks 621.
P. scleranthum Oliv.
Hucks 816.
Pupalia lappacea (L.) Juss.
G. & K. 12,684; Hucks 787.
Sericocomopsis hildebrandtii (C. B. Cl.) Schinz
Agnew et al. 7354; Napier Bax TNP/R/8A; Ossent 26.
S. pallida (S. Moore) Schinz
G. & K. 12,635; Napier 1006; Sheldrick TNPR. 8. Hucks 956; 267.

66 Zygophyllaceae

Tribulus cistoides L.
G. & K. 12,781; Hucks 474.
T. terrestris L.
G. & K. 12,817.

67 Geraniaceae

Monsonia senegalensis Guill. & Perr.
G. & K. 12,947.

72 Lythraceae

Ammannia auriculata Willd.
Hucks 1042.
Lawsonia inermis L.
G. & K. 12,649.

77 Onagraceae F. T. E. A. (1953).

Ludwigia pubescens (L.) Hara ssp. *brevisepala* (Brenan) Raven
Hucks 593; Napier 999.
L. stolonifera (Guill. & Perr.) Raven
G. & K. 13,003; 13,034.

81 Thymelaeceae

Gnidia latifolia (Oliv.) Gilg
Hucks 584; 781.

83 Nyctaginaceae

Boerhavia coccinea Mill.
Hucks 200; 248.
B. diffusa L.
Hucks 160; 767.
B. erecta L.
Hucks 106; 180.
B. repens L.
Hucks 1094.
Commicarpus pedunculosus (A. Rich.) Cuf.
Hucks 660.
C. plumbagineus (Cav.) Standl.
Napier 1051.
C. stellatus (Wight) Berhaut
G. & K. 12,880; Sheldrick B8571.

101 Passifloraceae

Adenia globosa Engl.
Hucks 843; Irwin 255.
A. gummifera (Harv.) Harms
Hucks 512.
A. keramanthus Harms
Gardner 3008.
A. scheffleri Engl. & Harms
G. 9544.
Adenia sp.
Hucks 1047.
Tryphostemma hanningtonianum Mast.
Hucks 531; 600.
T. lanceolatum Engl.
Hucks 327; 1072.
Tryphostemma sp.
G. & K. 12,810.

103 Cucurbitaceae F. T. E. A. (1967).

Cephalopentandra ecirrhosa (Cogn.) C. Jeffrey
Hucks 971.
Citrullus lanatus (Thunb.) Mansf.
Napier 1048.
Coccinia grandis (L.) Voigt
Hucks 392; 1040; 1080.
C. microphylla Gilg
Hucks 491.

103 Cucurbitaceae (*cont.*)

Coccinia trilobata (Cogn.) C. Jeffrey
Hucks 61; Verdcourt 3888.
Corallocarpus epigaeus (Rottl.) C. B. Cl.
Hucks 554; Verdcourt 1111.
C. schimperi (Naud.) Hook. f.
Bally b8588.
Cucumella engleri (Gilg) C. Jeffrey
Drummond & Hemsley 4220.
Cucumis aculeatus Cogn.
Napier Bax TNP/E/59.
C. dipsaceus Spach
Hucks 72; 80.
C. figarei Naud.
Verdcourt 3897.
C. prophetarum L. ssp. *dissectus* (Naud.) C. Jeffrey
Greenway EAH. 12,205; Hucks917; 1079.
C. sativus L.
Hucks 572.
Cyclantheropsis parviflora (Cogn.) Harms
Rauh Ks 827.
Gerrardanthus lobatus (Cogn.) C. Jeffrey
Agnew 7335; Hucks 120; 581.
Kedrostis foetidissima (Jacq.) Cogn.
Hucks 908; Sheldrick 1003; Verdcourt 3887.
K. gijef (J. F. Gmel.) C. Jeffrey
Hucks 891.
K. hirtella (Naud.) Cogn.
Hucks 560.
K. leloja (J. F. Gmel.) C. Jeffrey
Ossent 118.
K. pseudogijef (Gilg) C. Jeffrey
Hucks 444; 481.
Lagenaria sphaerica (Sond.) Naud.
Napier 969; R. Williams & Sheldrick TNP/E/101.
Momordica rostrata A. Zimm.
Napier 1023; Ossent 45.
M. trifoliolata Hook. f.
G. 10,809; G. & K. 12,989.
M. spinosa (Gilg) Chiov.
G.10,814; 876· Hucks
Peponium vogelii (Hook. f.) Engl.
Agnew 7337.
Trochomeria sp. 'A' = Padwa 186.
Hucks 518; 911; G. & K. 12,797.
Zehneria pallidinervia (Harms) C. Jeffrey
Drummond & Hemsely 4094; Irvin 382.
Zehneria sp.
Hucks 902.

114 Ochnaceae

Ochna inermis (Forsk.) Schweinf.
G. & K, 12,744.
O. ovata F. Hoffm.
Hucks 462.

121 Combretaceae

Griffiths, M. E., Revision of the African Species of *Terminalia*, *Journ. Linn. Soc. Bot.* **55**: 818 907 (1959), London.

Combretum aculeatum Vent.
G, & K. 12,666; 12,860.
C. exalatum Engl.
G. & K, 12,764; Hucks 473; 916.
C. grotei Exell
Hucks 526,
C. molle R. Br.
MacArthur B271.
C. ukambensis Engl.
G. & K. 12,843; Hucks 439.
Combretum sp. aff. *C. grotei* Exell
Greenway EAH. 12,204; Hucks 857.
Combretum sp.
Bally B8164; Drummond & Hemsley 4104.
Terminalia kilimandscharica Engl.
G. & K. 12,779; 13,058.
T. orbicularis Engl. & Diels
G. & K. 12,643; Hucks 320.
T. parvula Pamp.
G. & K. 12,641; 12,919.
T. prunioides Laws.
G. & K. 12, 640: 12,752; 12,837.
T. spinosa Engl.
Hucks 406.

126 Guttiferae

Garcinia livingstonei T. Anders.
G. & K. 13,011.

128 Tiliaceae

Corchorus olitorius L.
Hucks 143.
C. trilocularis L.
Greenway EAH. 12,203; Napier 904.
Corchorus sp. aff. *C. baldaccii* Mattei
G. & K. 12,951; Hucks 713.

128 Tiliacaae (*cont.*)

Grewia bicolor Juss.
Hucks 734; Sheldrick TNP/E/2.

G. forbesii Mast.
Agnew et al. 5827; Hucks 763.
G. nematopus K. Schum.
G. & K. 12,858; Ossent 62.
G. tenax (Forsk.) Fiori
Hucks 424,
G. villosa Willd.
Bally B8631; Hucks 316.
Triumfetta flavescens A. Rich.
Hucks 237; 350; 1061.

G. fallax K. Schum.
Greenway EAH. 12,201; G. & K. 12,820; Hucks 460.
G. lilacina K. Schum.
Hucks 334; Ossent 51.
G. tembensis Fres var. *kakothamnos* (K.Schum.) Burrett
Agnew et al. 7353; Ossent 127.
G. tristis K. Schum.
Hucks 423.

130 Sterculiaceae

Dombeya praetermissa Dunkley
Napier 1012, ex num. *Kew Bull.* 1934, p. 183.
Hermannia exappendiculata (Mast.) K. Schum.
Napier 982; Hucks 188.
H. glanduligera K. Schum.
G. & K. 12,905; Hucks 176.
H. uhligii Engl.
Hucks 403; Sheldrick T.N.P/E/107.
Melhania ovata (Cav.) Spreng.
Napier 926; Moore & Sheldrick TNP/E/159.
M. velutina Fosrk. (Syn. *M. ferruginea* A. Rich.)
TNP/E/73.
Sterculia africana (Lour.) Fiori
G. 9547; Trapnell 2224.
S. stenocarpa H. Winkl.
G .10,811; G. & K. 12,676; 13,078; Hucks 314.
Waltheria indica L.
G. & K. 12,715; Napier 963; Sheldrick & Moore TNP/E/152.

D. umbraculifera K. Schum.
Agnew et al. 5812.
H. fischeri K. Schum.
Drummond & Hemsley 4098.
H. oliveri K. Schum.
G. 10,463; Macdonald 868.

M. taylori Bak. f.
Bally B8691; Hucks 18.

S. rhynchocarpa K. Schum.
G. & K. 13,077.

131 Bombacaeae

Adansonia digitata L.
Hucks 893.

132 Malvaceae

Abutilon fruticosum Guill. & Perr.
G. 9,502; Hucks B328.
A. hirtum (Lam.) Sweet
Nattrass 1053.
Hibiscus aponeurus Sprague & Hutch.
Hucks 279; 821.
H. cannabinus L.
Napier 1060.
H. micranthus L. f.
Hucks 358; Sheldrick & Moore TNP/E/137.
H. surattensis L.
Napier 991.
Pavonia arabica Boiss.
Bally B8669; G. & K. 12,896.
P. grewioides Boiss.
Hucks 992.
P. zeylanica (L.) Cav.
G. & K. 12,906; Hucks 344.
Pavonia sp.
Napier1032; Ossent 120.
Sida ovata Forsk.
Drummond & Hemsley 4096; G. & K. 13,022.
Thespesia danis Oliv.
Burch 62/86.

A. grandiflorum Don
Napier Bax TNP/E/28.
A. mauritianum (Jacq.) Medic.
Hucks B313.
H. calyphyllus Cav.
Hucks 39; 354.
H. greenwayi Bak. f.
Bell H157/56.
H. palmatus Forsk.
G. & K. 12,944; Hucks 56.
H. vitifolius L. (or related species)
G. & K. 12,683; Hucks 252.
P. elegans Guerke
G. & K. 12,819; Hucks 29.
P. patens (Andr.) Chiov.
G. & K. 13,083; Hucks 313.
P. zeylanica (L.) Cav. var. *microphylla* Ulbr.
McDonald 867.

S. rhombifolia L.
Gregory sn., not seen.

133 **Malpighiaceae** F. T. E. A. (1968).

Acridocarpus zanzibaricus A. Juss.
Hucks 505;889
Caucanthus albidus (Nied.) Nied.
G. & K. 12,885; Hucks 425.
C. auriculatus (Radlk.) Nied.
G. 9741; Ossent 152.
Triaspis erlangeri Engl.
G. & K. 12,735; Napier 1036.
T. niedenzuiana Engl.
G. & K. 12,757; Hucks 352; Verdcourt 3892.

136 **Euphorbiaceae**

Acalypha ciliata Forsk.
G. & K. 12,841; Polhill & Paulo 952.
A. fruticosa Forsk.
Napier Bax TNP/E/R71; Sheldrick TNP/E/82.
A. indica L.
Bally B8044.
Bridelia taitensis Pax & Vatke
Agnew et al. 7327; G. & K. 12,892.
Cephalocroton nudus Pax & K. Hoffm.
G. & K. 12,727.
Croton confertus Bak. e desc.
G. & K. 13,088.
C. dichogamus Pax
Bally B8596; G. & K. 12,825.
Dalechampia scandens L.
Hucks 390.
D. scandens L. var. *cordafana* Muell. Arg.
G. & K. 12,803; Hucks 73.
D. trifoliata Verdc. & Greenway
Hucks 1057; Polhill & Paulo 927.
Erythrococca atrovirens (Pax) Prain
G. 9614.
Euphorbia acalyphoides Boiss.
G. & K. 12,798.
E. agowensis Boiss. var. *pseudoholstii* (Pax) Carter & Bally
G. & K. 12,721.
E. cryptospinosa Bally
G. & K. 12,665; 13,021; Verdcourt 3225.
E. cuneata Vahl
Hucks 842.
E. cuneata Vahl *var. nov.*,
Gardner B6358
E. engleri Pax
G. & K. 12,678
E. espinosa Pax
Bally B10,451; Verdcourt 1847 (3).
E. gossypina Pax var. *gossypina*
Hucks 841.
E. grandicornis Goebel.
G. & K. 13,071.
E. heterochroma Pax
Hucks 220.
E. hirta L.
G. & K. 12,666; Napier 936.
E. jatrophoides Pax
G. & K. 12,762; 12,805.
E. kibwezensis N. E. Br.
Trump sn.
E. ndurumensis (Pax) Bally (Syn. *E. taitensis* Pax) F. T. Afr. 6, 1: 571 (1911).
Hildebrandt 2859; Kaessner 430; Mildbraed 12 ex num. Greenway EAH. 12,027; G. 9830 and 9831; G. & K. 12,956; Napier 988.
E. nyikae Pax
Polhill & Paulo 472.
E. polyantha Pax
G. 9765; G. & K. 12,739.
E. quinquecostata Volkens
G. & K. 12,826; Verdcourt 3891.
E. robecchii Pax
G. & K. 12,831;
E. scheffleri Pax
G. & K. 12,767; Hucks 156.
E. schinzii Pax, complex fide Kew.
G. 9830.
E. spinescens Pax
G. 10,817; Hucks 167; Polhill & Paulo 478; Verdcourt 2381. This species according to Carter & Bally is the same as *E. cuneata* Vahl, but the specimens cited are nothing like it.
E. systyloides Pax
Napier 1058.
E. tirucallii L.
Sheldrick TNP/E/108.
Euphorbia sp. aff. *E. uhligiana* Pax, complex fide Kew
G. 9831.
Euphorbia sp.
Hucks 849.
Euphorbia sp.
Hucks 863.
Euphorbia sp,
Schenkal 45.
Excoecaria venifera Pax
Scheldrick TNP/E/93.

136 **Euphorbiaceae** (*cont.*)

Givotia gosai A.R. Smith
G. 12,521; G. & K. 12,650; Hucks 870; Moore & Napier - Bax TNP/GS/3 type

Jatropha dichtar Mildbr.
Rauh 12,519.

J. parvifolia Chiov.
G. & K. 12,756; Hucks 801.

J. spicata Pax
G. & K. 12,657; 12,719; Napier 920.

Jatropha sp. nr. *J. stuhlmannii* Pax
Bally B8664.

Monadenium invenustum N. E. Br.
G. & K. 13,044.

Phyllanthus maderaspatensis L.
G. & K. 12,800; Sheldrick & Moore TNP/E/130.

P. somalensis Hutch.
Sheldrick TNP/R/106.

Phyllanthus sp. cfr. *P. niruri* L.
Polhill & Paulo 921.

Ricinus communis L.
Williams & Sheldrick TNP/E/105

Securinega virescens (Willd.) Baill.
G. & K. 12,704.

Spirostachys africana Sond.
G. & K. 12,923; 13,012; it is possible that these two specimens may be *Excoecaria venifera* Pax, but their flowers are not fully developed.

Tragia arabica Baill.
Hucks 109; Verdcourt 1597.

T. brevipes Pax
Bally B7707.

T. hildebrandtii Muell. Arg.,
G. 9826 fide Kew: G. & K. 12,792.

T. subsessilis Pax
G. & K. 12,791.

Tragia sp.
Hucks 488

146 **Caesalpiniaceae** F. T. E. A. (1967).

Bauhinia taitensis Taub.
G. & K. 12,691; 12,728.

B. tomentosa L.
Tompson B7813.

Caesalpinia trothae Harms ssp. *erlangeri* (Harms) Brenan
Hucks 291; 414.

C. trothae Harms ssp. *trothae*
Bally B8681; Verdcourt 1588.

Cassia abbreviata Oliv. ssp. *kaessneri* (Bak. f.) Brenan
Verdcourt 1592.

C. absus L.
Ossent 268.

C. bicapsularis L.
G. & K. 12,987; Hucks 398.

C. fallacina Chiov.
G. & K. 12,943; Hucks 26.

C. longiracemosa Vatke
G. 9744; 10,807; G. & K. 12,945.

C. occidentalis L.
G. & K. 12,961; Napier 971.

C. mimosoides L.
Hucks 101.

C. mimosoides L. Group E.
Ossent 260.

Delonix elata (L.) Gamble
G. & K. 12,730; Hucks 348.

Tamarindus indica L.
G. & K. 12,732.

Tylosema fassoglensis (Schweinf.) Torre & Hillcoat
Hucks 217; Williams EAH. 12,536.

147 **Mimosaceae** F. T. E. A. (1959).

Acacia brevispica Harms
G. & K. 12,855.

A. bussei Sjostedt
Trapnell 2210.

A. clavigera E. Mey. ssp. *usambarensis* (Taub.) Brenan
Hucks 967.

A. elatior Brenan ssp. *elatior*
Sr. G.

A. horrida (L.) Willd. ssp. *benadirensis* (Chiov.) Brenan
Dale 3891; Trapnell 2212.

A. mellifera (Vahl) Benth. ssp. *mellifera*
Hucks 871.

A. nilotica (L.) Del. ssp. *subalata* (Vatke) Brenan
G. & K. 12,958; Sheldrick TNP/E/88.

A. polyacantha Willd. ssp. *campylacantha* (A. Rich.) Brenan
Jeffrey 808.

A. stuhlmannii Taub.
Sr. G.

A. reficiens Wawra ssp. *misera* (Vatke) Brenan
G. & K. 12,939.

A. thomasii Harms
G. & K. 12,861; Hucks 185

A. tortilis (Forsk.) Hayne ssp. *spirocarpa* (A. Rich.) Brenan
Hucks 427; 865.

A. zanzibarica (S. Moore) Taub.
Hucks 937.

147 **Mimosaceae** (*cont.*)

Albizia anthelmintica (A. Rich.) Brong. n.
Hucks 831; TNP/E/75.

A. glaberrima (Schumach. & Thonn.) Benth. var. *glabrescens* (Oliv.) Brenan
G. & K. 12,776; Jeffery 812.

A. zimmermannii Harms
G. & K. 12,702.

Dichrostachys cinerea (L.) Wight & Arn. ssp. *africana* Brenan & Brumm.
Bally 8161.

Entada leptostachya Harms
Braun 1540; Hucks 704.

Neptunia oleracea Lour.
Napier Bax TNP/G3/7

Newtonia hildebrandtii (Vatke) Torre var. *hildebrandtii*
G. & K. 12,708; Hucks 224.

148 Papilionaceae

Abrus schimperi Bak. ssp. *africana* (Vatke) Verdc.
Napier 976; Polhill & Paulo 957.

Aeschynomene indica L.
G. & K. 12,936; 13,066.

Alysicarpus sp.
Sr. G.

Clitoria ternatea L.
G. & K. 13,074; Hucks 326.

Craibia brevicaudata (Vatke) Dunn var. *brevicaudata*
G. & K. 13,027; Verdcourt & Polhill 2715.

Crotalaria agatiflora Schweinf. ssp. *agatiflora*
Hucks 340.

C. laburnifolia L.
Hucks 437; 428.

C. patula Polhill
Bogdan 5327; Drummond & Hemsley 4055.

C. scassellatii Chiov.
G. & K. 12,740; Polhill & Paulo 936.

C. zimmermannii Bak. f.
G. 10,436; Hucks 280.

C. glauca Willd.
Gregory sn., not seen.

C. laburnifolia L. ssp. *tenuicarpa* Polhill
Gillett 17,219; G. 9501; G. & K. 12,815.

C. polysperma Kotschy
Hucks 307; 545.

C. tsavoana Polhill
G. & K. 12,938; 13,047.

C. ukambensis Vatke
Hucks 789; Polhill & Paulo 932.

Dalbergia melanoxylon Guill. & Perr.
G. & K. 13,028.

Dolichos uniflorus Lam. var. *stenocarpa* Brenan
Hucks 1025; Napier 1011.

Erythrina melanacantha Taub.
Sr. G.; Hucks 941.

Indigofera arrecta A. Rich.
G. & K. 13,025; Hucks 705.

I. costata Guill. & Perr. ssp. *goniodes* (Bak.) Gillett
G. & K. 12,714; Hucks 652A.

I. hirsuta L. var. *hirsuta*
Hucks 571; Napier 990.

I. hochstetteri Bak.
Hucks 866.

I. malindiensis Gillett n. sp. ined.
Schenkel 35.

I. schimperi Jeub & Spach. var. *schimperi*
G. & K. 12639; 12899; Hucks 92.

I. schimperi Jaub. & Spach var. *baukeana* (Vatke) Gillett
Jeffrey 816; Napier 992.

I. sesilis Gillett
Sampson 97; Verdcourt 3875.

I. spinosa Forsk.
G. 9780; G. & K. 12,946.

I. tanganyikensis Bak. f. forma *paucijuga* Gillett
Drummond & Hemsley 4056 holotype; Gillett 17, 187. Sr. G.

I. trita L. f. var. *subulata* (Poir.) Ali

I. vohemarensis Baill.
Schenkl 66; Sheldrick & Moore TNP/E/162.

I. volkensii Taub.
Bally B8159.

Indigofera sp.
Napier Bax TNP/R/90.

I. microcharoides Taub. var. *latestipulata* Gillett ined.
Gillett 16,867.

Lonchocarpus eriocalyx Harms
Sr. G. Hucks 257.

Neorautanenia mitis (A. Rich.) Verdc. ined. (Syn. *N. pseudopachyrrhizus* Harms).
Beaton 50.

Ormocarpum kirkii S. Moore
Thompson B7815.

Papilionaceae (*cont.*)

Ophrestia hedysaroides (Willd.) Verdc. (Syn. *Paraglycine hedysaroides* (Willd.) F. T. Herm.)
Ossent sn.
Platycelyphium voense (Engl.) Wild
G. & K. 12,712; Hucks 191.
Rhynchosia minima (L.) DC.
Drummond & Hemsley 4136; Napier 996A
R. pulchra (Vatke) Harms
Greenway EAH. 12,585; Hucks 677.
R. sennarensis Hochst.
Hucks 694.
R. sublobata (Schumach.) Meikle
Hucks 124; 592; Verdcourt 1108.
R. velutina Wight & Arn.
Tweedie 3200.
Sesbania quadrata Gillett
Hucks 324; 1077.
S. sericea (Willd.) Link.
G. & K. 12,065.
S. sesban (L.) Merr. var *nubica* Chiov.
Williams & Sheldrick TNP/E/102.
Spathionema kilimandscharicum Taub.
G. 9820; Napier 950; Polhill & Paulo 471; Verdcourt 2346.
Stylosanthes fruticosa (Retz.) Alston
G. & K. 12,813.
Tephrosia lortii Bak. f.
Hucks 994; Napier 928.
T. noctiflora Bak.
G. 9742; G. & K. 12,955.
T. pentaphylla (Roxb.) G. Don
G. & K. 12,877.
T. pumila (Lam.) Pers. var. *pumila*
Hucks 148; 76b.
T. purpurea (L.) Pers. var. *pubescens* Bak.
Gregory sn., not seen.
T. subtriflora Bak.
G. 10,461; G. & K. 12,812; Napier 929.
T. uniflora Pers.
Hucks 663; Verdcourt 1110.
T. villosa (L.) Pers. ssp. *ehrenbergiana* (Schweinf.) Brumm.
G. 9745; G. & K. 13,014; Sheldrick TNP/E/1.
Vatovaea pseudolablab (Harms) Gillett
Hucks 85; 586; 1,000.
Vigna membranacea A. Rich. ssp. *caesia* (Chiov.) Verdc.
Greenway 10,429; G. & K. 12,643; 12,942; P. Bax TNP/R/69.
V. kirkii (Bak.) Gillett
Napier 994.
V. praecox Verdc.
Bally 8560; Hucks 449; Polhill & Paulo 469.
V. unguiculata (L.) Walp. ssp. *cylindrica* (L.) van Eseltine
Sheldrick & Moore TNP/E/134.
Zornia glochidiata DC.
G. & K. 12,771.

156 **Salicaceae**

Populus ilicifolius (Engl.) Rouleau
G. & K. 12,760; 12,902.

167 **Moraceae**

Dorstenia ? crispa Engl.
Verdcourt 3880.
Ficus ingens (Miq.) Miq.
G. & K. 12,703
F. mucuso Ficalho
Hucks 970.
F. populifolia Vahl
G. & K. 12,763; Polhill & Paulo 938.
F. sonderi Miq.
G. & K. 13,031; Hucks 37.
F. sycomorus L.
G. & K. 13,082; Williams & Sheldrick TNP/E/103.

173 **Celastraceae**

Cassine aquifolium Fiori
G. & K. 12,940; 13,049.
Hippocratea africana (Willd.) Loes.
G. & K. 13,010.
Maytenus senegalensis (Lam.) Exell
Hucks 820.

179 **Icacinaceae** F. T. E. A. (1968).

Pyrenacantha malvifolia Engl.
Polhill & Paulo 475; Verdcourt 3190; Lucas, Jeffrey & Kirika 269.

180 **Salvadoraceae** F. T. E. A. (1968).

Azima tetracantha Lam.
Bally B8742; G. & K. 12,699.
Dobera glabra (Forsk.) Poir.
Napier Bax TNP/GS/6; Agnew et al. 7330.
D. loranthifolia (Warb.) Harms
G. & K. 12,698; 12,780.
Salvadora persica L.
G. & K. 12,709; Napier Bax TNP/E/48.

182 **Olacaceae** F. T. E. A. (1968).

Ximenia americana L.
Sheldrick TNP/E/80

185 **Loranthaceae**

Amyena panganensis (Engl.) Balle
Drummond & Hemsley 4103; G. 9832.
Erianthemum occulatum (Sprague) Danser
G. 9542 fide Kew.
Helixanthera kirkii (Oliv.) Danser
Rauh Ke648.
Loranthus triplinervius Baker & Sprague
Hucks 1036.
L. schimperi Jaub. & Spach var. *schimperi*
G. & K. 12,639; 12,899; Hucks 92.
Oliverella hildebrandtii (Engl.) van Tiegh.
Hucks 747; Napier Bax TNP/GS/20.
Plicosepalus curviflorus (Benth.) Danser
Hucks 402.
P. sagittifolius (Sprague) Danser
Hucks 959.
Tapinanthus sansibarensis (Engl.) Danser
Hucks 679.
Tapinanthus sp.
Williams & Sheldrick TNP/E/97.

190 **Rhamnaceae**

Berchemia discolor (Klotzsch) Hemsl.
Dale 3676; G. & K. 12,664.
Helinus integrifolius (Lam.) Kuntze
G. & K. 12,816; Hucks 764.
Ziziphus mucronata Willd.
Bally B8641; G. & K. 12,694.

193 **Vitaceae (Ampelidaceae)**

Ampelocissus africana (Lour.) Merr.
G. & K. 13,019.
Cissus aphyllantha Gilg
Napper 1339; Verdcourt 1587.
C. quadrangularis L.
Hucks 721.
Cyphostemma adenocaulis A. Rich.
Hucks 296; 731.
C. cactiformis Gilg
G. & K. 12,996; Hucks 1046; Napier 1022.
C. rotundifolia (Forsk.) Vahl
G. & K. 12,857; Hucks 161.
Cyphostemma sp.
Agnew et al. 7338.

194 **Rutaceae**

Fagara chalybea (Engl.) Engl.
G. & K. 12,908.
Vepris eugeniifolia (Engl.) Verdoorn
Agnew et al. 5828; Drummond & Hemsley 4063.
V. uguenensis Engl.
Gardner 2961; Ossent 121.
Vepris sp. nov. = Dale & Greenway, Trees and Shrubs of Kenya, p. 493.
G. & K. EAH. 13,718.

195A **Balanitaceae**

Balanites orbicularis Sprague
G. & K. 12,889; 12,971

196 **Burseraceae**

Boswellia hildebrandtii Engl.
G. 9617; 10,815; G. & K. 12,690; Sheldrick TNP/E/19.
Commiphora africana (A. Rich.) Engl.
Agnew et al. 7323.
C. campestris Engl.
Bally B8630; Dale 3895B; Polhill & Paulo 473.
C. mildbraedii Engl.
Mildbraed 5 type; Verdcourt 3871.
C. scheffleri Engl.
G. 9789; 9827 fide Kew.
Commiphora sp. nr. *C. madagascariensis* Jacq. and *C. merkeri* Engl. fide Kew.
G. & K. 12,658.
Commiphora spp.
Gillett 16,857; 17,189; 17,192.
Commiphora sp.
G. & K. 12,893; 12,894.
Commiphora sp. = Bally 1667
G. & K. 12,661; Verdcourt 3889.
C. boiviniana Engl.
G. & K. 12,828; Verdcourt 3895; 1113.
C. holtziana Engl.
G. & K. 12,633; 12,747; Sheldrick TNP/E/77.
C. riparia Engl.
G. 10,813 fide Kew; G. & K. 12,682.
C. trothae Engl.
Ivens 410
Commiphora sp.
G. in E.A.H. 12,221.
Commiphora sp.
G. & K. 12,655; 12,896.
Commiphora sp.
Verdcourt & Polhill 2709.

197 **Meliaceae**

Melia volkensii Guerke
Gillett & Burtt 17,048; Hucks 99.
Trichilia roka (Forsk.) Chiov.
Hucks 878; 290; Sheldrick 1004.

198 **Sapindaceae**

Aphania senegalensis (Poir.) Radlk.
G. & K. 12,995; G. & K. EAH. 13,719.
Cardiospermum corindum L.
Napier 1068.
C. halicacabum L.
G. & K. 12,848; Hucks 725.
Deinbollia borbonica Scheff.
Drummond & Hemsley 4277.
Haplocoelum foliolosum (Hiern) Bullock
Bally B8595; Schenkel 77.
Lecaniodiscus fraxinifolius Bak.
G. & K. 13,055; G. & K. EAH, 13.720; Sheldrick TNP/E/86.

205 **Anacardiaceae**

Lannea alata (Engl.) Engl.
G. 9617; G. & K. 12,687; Sheldrick TNP/E/7.
L. stuhlmannii (Engl.) Engl.
G. & K. 12, 655.
L. triphylla (A. Rich.) Engl.
G. 9766; 9787 fide Kew; Sheldrick TNP/E/115.
Lannea sp. nov.?=G. 9256 and Makin EAH. 13,721.
G. & K. 12,746; 13,067.
Lannea sp.=Bally 117.
G. 9543.

213 **Umbelliferae**

Berula erecta (Huds.) Coville
Bogdan 3612A. (Tsavo River).
Steganotaenia araliacea Hochst.
Sr. G.

II METACHLAMYDEAE
(Families Nos. 221–264)

221 **Ebenaceae**

Diospyros consolatae Chiov.
G. & K. 12,907; 13,057.
D. cornii Chiov.
Sheldrick TNP/E/87; Verdcourt 3886.

222 **Sapotaceae** F.T.E.A. (1968).

Manilkara mochisia (Baker) Dubard
G. 9785 fide Kew; Sheldrick TNP/E/112.
M. fruticosa DC.
G. & K. 13,017; Hucks 411
Mimusops sp. cfr. *M. schliebenii* Mildbr.
G. & K. 13,085 fide Kew.

228 **Loganiaceae** F.T.E.A. (1960).

Strychnos decussata (Pappe) Gilg
G. & K. 12,629; 12,663; Hucks 513.
S. madagascariensis Poir.
G. & K. 12,660; 12,685.

229 **Oleaceae** F.T.E.A. (1952).

Jasminum grahamii Turrill
Graham 1658 type.
J. parvifolium Knobl.
G. & K. 12,705; Hucks 516.

230 **Apocynaceae**

Adenium obesum (Forsk.) Roem. & Schult.
G. 10,810; G. & K. 12,769; Hucks 123.

Carissa edulis Vahl
Ossent 129; MacArthur B274.
**Catharanthus roseus* (L.) G. Don
Hucks 95.
Holarrhena febrifuga Klotzsch
G. & K. 12, 653; Hucks 539.
Strophanthus mirabilis Gilg
G. 9825; G. & K. 12,871; Hucks 827.

231 Asclepiadaceae

Baseonema gregorii Schlecht. & Rendle
Bally B 8745; Hucks 678; Verdcourt & Polhill 2695.
Calotropis procera (Ait.) Ait.
G. & K. 12,729; Hucks 192.
Caralluma priogonium K. Schum.
EAH. 95.
C. speciosa (N. E. Br.) N. E. Br.
Sr. G.; Shirtliffe EAH. 13,596.
C. russelliana (Brongn.) Cuf.
Hucks 1045
C. turneri E. A. Bruce
G. & K. 12,652.
Cynanchum defoliascens K. Schum.
Hucks 983.
C. omissum Bullock
Drummond & Hemsley 4045 type.
C. validum N. E. Br.
Sr. G.
C. hastifolium N. E. Br.
Hucks 272.
C. tetrapterum (Turcz) R. A. Dyer
Napier 1064.
Diplostigma canescens K. Schum.
Greenway EAH. 11,700; G. & K. 12,711; Hucks 282.
Dregea stelostigma (K. Schum.) Bullock
Hucks 356; 382; Verdcourt 2395.
Echidnopsis dammanniana Sprenger?
G. & K. 12,954.
Edithcolea grandis N.E. Br.
Sr. G.; Hucks s. n.
Glossonema revoilii Franch.
Hucks 828.
Kanahia laniflora (Forsk.) R. Br.
G. & K. 12,921; Hucks 412.
Oxystelma bornuense R. Br.
G. & K. 13,051; Verdcourt 2396.
Pergularia daemia (Forsk.) Chiov.
G. 10,462; Hucks 304; 900; Napier Bax TNP/E/43.
Sacleuxia newii (Benth.) Bullock
Gillett 17,327; G. & K. 12,852.
Sarcostemma viminale R. Br.
G. & K. 12,679; Hucks 1037.
Sarcostemma sp.
Ossent 125; Verdcourt 3227.
Schlechterella africana (Schlecht.) K. Schum.
G. 9546; 10,816; G. & K. 13,091.
Secamone punctulata Decne var. *stenophylla* (K. Schum.) N. E. Br.
G. & K. 12,645; Hucks 497.
Stathmostelma pedunculatum (Decne) K. Schum.
Leaky B3166.

232 **Rubiaceae**

Borreria scabra (Schumach. & Thonn.) K. Schum. s. l.
G. 9772; 10,431; Hucks 688; Polhill Paulo 930.
Dirichletia glaucescens Hiern
G. 10,465; G. & K. 12,677; 12,737.
Gardenia jovis-tonantis (Welw.) Hiern
G. & K. 13,026.
Hymenodictyon parvifolium Oliv.
G. 9541; G. & K. 12,680; Hucks 570.
Kohautia caespitosa Schinz var. *amaniensis* (K. Schum.) Brem.
G. & K. 13,013; Hucks 1075; Napier 1063.
Meyna tetraphylla (Hiern) Robyns
G. & K. 12,777; 13,076.
Oldenlandia herbacea Roxb. var. *holstii* (K. Schum.) Brem.
Napier 1335.
O. somala Chiov.
G. & K. 12,935; Hucks 807;
O. wiedermannii K. Schum.
G. & K. 12,750; Drummond & Hemsley 4099.
Paederia pospischilii K. Schum.
G. & K. 12,801; Hucks 283; Napier 1050.
Pentanisia ouranogyne S. Moore
G. & K. 12,786; Hucks 16; Napier 1041.
Pentas bussei Krause intermed. *P. parvifolia* Hiern
Ossent 6.
P. parvifolia Hiern
Bally B4722; Hucks 367.

232 **Rubiaceae** (*cont.*)

Pentodon pentander (Schumach.) Vatke var. *minor* Brem.
Napier 997.
Psychotria kirkii Hiern
Ossent 247.
P. nairobiensis Brem.?
G. & K. 12,774; 12,824.
Psychotria sp.
Schenkel 69; this has been named *P. nairobiensis* Brem. but is quite sterile.
Rytigynia sp. nr. *R. loranthifolia* (K. Schum.) Robyns
Hucks 932.
Tarenna graveolens (S. Moore) Brem.
G. 9625: Hucks 559.
Tricalysia ovalifolia Hiern
Graham 1615.
Xeromphis keniensis Tennant sp. nov.
G. 9613; 9740 type; 10,857; Hucks 657.

238 **Compositae**

Acanthospermum hispidum DC.
G. & K. 12,962; Hucks 378.
Aspilia mossambicensis (Oliv.) Wild
G. & K. 13,084; Hucks 611; Napier Bax TNP/R/60.
Athroisma psyllioides (L.) L.
G. & K. 12,965.
Bidens incumbens Scherff
Hucks 741; Napier 1016 type; Verdcourt 3890A.
Blepharispermum fruticosum Klatt & Schinz ssp. *lanceolatum* Chiov.
Hucks 420; 639.
B. zanzibaricum Oliv. & Hiern
G. & K. 12,992.
Blumea aurita (L.) DC.
Hucks 869.
Blumea sp. = Hucks 176; 898, but not *B. caffra* (DC.) O. Hoffm.
G. & K. 13,005; 13,042.
Conyza aegyptiaca Ait. var.?
G. & K. 12,673 cfr. Drummond & Hemsley 4066.
Dicoma tomentosa Cass.
Sr. G.
Eclipta prostrata (L.) L.
G. & K. 12,982; Hucks 32.
Erlangea boranensis S. Moore
Hucks 275.
Erlangea marginata (O. & H.) S. Moore
Ossent 31.
Erythrocephalum longifolium Benth.
Lady Muriel Jex Blake B5078
Galinsoga parviflora Cav.
Sheldrick TNP/E/109
Geigeria acaulis Oliv. & Hiern
G. & K. 12,948.
Grangea maderaspatana Poir.
G. & K. 13,063.
Gutenbergia polycephala Oliv. & Hiern
G. & K. 12,839.
Helichrysum glumaceum DC.
G. & K. 12,963; Hucks 165; 198.
Hirpicium diffusum (Oliv.) Roessl.
Shanz & Turner 4243.
Kleinia kleinioides (Sch. Bip.) M. R. F. Taylor vel sp. aff. (Taxon 26 of Jeffrey MS.)
Sr. G. Rauh 1; Napier 1057.
Launaea cornuta (Oliv. & Hiern) C. Jeffrey
G. & K. 12,862; Napier 925.
L. intybacea (Jacq.) Beauv.
G. & K. 13,037; Hucks 966.
Microglossa oblongifolia F. Hoffm.
Napier 935.
Notonia sp.
Hucks 966.
Osteospermum vaillantii (Decne) T. Norl. (Syn. *Tripteris vaillanti* Decne).
Gregory sn., not seen.
Pegolettia senegalensis Cass.
Hucks 479.
Pluchea dioscoridis DC.
G. & K. 12.988; Hucks 442; Williams & Sheldrick TNP/E/99
P. ovalis (Pers.) DC.
G. & K. 12,984; Hucks 62

238 **Compositae** (*cont.*)

Pluchea sordida (Vatke) Oliv. & Hiern
Agnew et al. 7357
Sclerocarpus africanus Murr.
Bally B4714; Hucks 377
Senecio discifolius Oliv.
Hucks 558
Sphaeranthus napierae Ross-Craig
G. & K. 13,002
Spilanthes mauritiana (A. Rich.) DC.
Ag. Lab. Nairobi B10226
Tridax procumbens L.
G. & K. 13,023; Hucks 90.
Vernonia aemulans Vatke
Hucks 680; 762.
V. cinerea (L.) Less.
MacArther B265.
V. hildebrandtii Vatke
G. & K. 12,692; Hucks 330; 873.
V. wakefieldii Oliv.
Gillett 16,873; G. & K. 12,706.

S. stuhlmannii Klatt
MacArthur B270
S. ukambensis O. Hoffm.
Hucks 868

V. cinerascens Sch. Bip.
Hucks 323; 770; Napier Bax TNP/E/68.
V. colorata Drake
Hucks 274.
V. pauciflora Less.
Gregory sn., not seen.
Vernonia sp. aff. *V. cinerascens* Sch. Bip.
Hucks 1034.

239 **Gentianaceae**

Enicostema hyssopifolia (Willd.) Verdoorn
Napier 959.

241 **Plumbaginaceae**

Plumbago zeylanica L.
Hucks 309.

244 **Lobeliaceae**

Lobelia anceps L. f. var. *anceps*
Hucks 277.

L. holstii Engl.
Agnew et al. 7419.

249 **Boraginaceae**

Coldenia procumbens L.
G. & K. 13,061; Hucks 144; 1076.
Cordia gharaf (Forsk.) Aschers.
Napier Bax TNP/E/R/70.

C. ovalis R. Br.
Bally B8629; Hucks 890; Verdcourt 3895B.

Cordia sp. nov. aff. *C. goetzei* Guerke=Bally 12,053; Rawlins 351; Verdcourt 1862A. fide Kew.
G. & K. 13,053; Hucks 418.
Cordia sp.
Agnew et al. 7349; Polhill & Paulo 474.
Ehretia teitensis Guerke
G. & K. 12,838; 12,890; Hucks 277.
Heliotropium albohispidum Bak.
G. & K. 12,814; Hucks 652B
H. ? *marifolium* Retz.
Hucks 1052.
H. steudneri Vatke
G. & K. 12,830; Hucks 532C; 1065.
McDonald 880.
Heliotropium subulatum (DC.) Martelli
G. 10,432; G. & K. 12,842; Hucks 201.
Heliotropium sp. nr. *H. steudneri* Vatke
G. & K. 12,713 fide Kew; Hucks 53.
Trichodesma zeylanica (L.) R. Br.
G. & K. 12,924; Hucks 149; 851; Napier 962.

Ehretia sp. aff, *E. obtusifolia* DC.
Hucks 1028.
H. indicum L.
Hucks 86; 532B; 650.
H. ovalifolium Forsk.
Hucks 899.
H. strigosum Willd.
G. & K. 12,637; Hucks 693; Polhill & Paulo 919
H. supinum L.
Hucks 128; 1035.
Heliotropium sp.
Hucks 1064.

250 **Solanaceae**

Capsicum frutescens L.
Napier 965.
Datura metel L.
Hucks 63.
Lycium europaeum L.
Hucks 405.

250 Solanaceae (*cont.*)

Solanum dubium Fres.
Hucks 482; 1063.
S. incanum L.
Hucks 626; 720.
S. renschii Vatke
Hucks 284; 918; Napier Bax TNP/E/41.
S. taitense Vatke
G. 9822; G. & K. 12,768; Hucks 404; Polhill & Paulo 480.
Withania somnifera (L.) Dunal
G. & K. 12,891; Hucks 740; 853.

S. hastifolium Dunal
Hucks 756; 825; 1055.
Solanum nigrum L.
Hucks 613; 627.
S. somalense Franch. var. *planifrons* Bitter e desc.
Hucks 552; 612A; Ivens 412.

251 Convolvulaceae F. T. E. A. (1963).

Astripomoea hyoscyamoides (Vatke) Verdc.
Hucks 576; Napier 993; Napier Bax TNP/E/27.
Convolvulus rhyniospermus Chiosy
Hucks 808.
Evolvulus alsinoides (L.) L.
G. & K. 12,964; Hucks 799.
Hildebrandtia sepalosa Rendle
Ossent 10; 50; 54; G. & K. 12,749; 12,887.
Ipomoea arachnosperma Welw.
Bally B8974; Hucks 226.
I. cairica (L.) Sweet
Hucks 11.
I. eriocarpa R. Br.
Napier 1049.
I. hartmannii Vatke
Hucks 269; Verdcourt & Polhill 2763
I. irwinae Verdc.
Hucks 12.
I. longituba Hall. f.
Hucks 867.
I. ochracea (Lindl.) G. Don var. *ochracea*
G. & K. 12,997; Hucks 10; 88,
I. mombassana Vatke
Hucks 13; Napier Bax TNP/E/14.

I. bullata Oliv.
Bally B8613; Hucks 760; Ossent 126.
I. cicatricosa Bak.
Hucks 640.
I. garckeana Vatke
G. 9788; Hucks 1071; Verdcourt 1196.
I. hildebrandtii Vatke
Irwin 156.
I. kituiensis Vatke
Hucks 742; Napier 1072.
I. obscura (L.) Ker.-Gawl.
Hucks 130; 730; 846.
I. oenotherae (Vatke) Hall. f.
Ossent sn.
I. pes-tigridis L. var. *pes-tigridis*
Hucks 150; 1031.

I. sinensis (Desr.) Choisy ssp. *blepharosepala* (A. Rich.) Meeuse
Hucks 216; 238.
I. transvaalensis Meeuse ssp. *orientalis* Verdc.
Verdcourt 1199 type.

Ipomoea sp. nov. = Leipert 6072, from th
W. Pare Mtns.
Hucks 9944.

Jacquemontia tamnifolia (L.) Griseb.
Hucks 195; 664; 810.
Merremia ampelophylla Hall. f.
G. 9777; Hucks 567; 115; Verdcourt 1198.

M. pinnata (Choisy) Hall. f.
Hucks 214; 618.

M. tridentata (L.) Hall. f. ssp. *angustifolia* (Jacq.) v. Ooststr.
Hucks 672.
Seddera hirsuta Hall. f. var. *gracilis* (Chiov.) Verdc.
G. & K. 12,933; Schenkel 56.
Stictocardia incomta (Hall. f.) Hall. f.
Sr. G.; Hucks 1074.
Turbina stenosiphon (Hall. f.) Meeuse
Sr. G.

252 Scrophulariaceae

Alectra vogelii Benth.
Agri. Officer 796.
Craterostigma sp. nov.
Hucks 511; 561; Martin 87.
Buttonia hildebrandtii Engl.
Dale 3861; G. 9829; Napier 875; Verdcourt 3895a.
Harveya obtusifolia (Benth.) Vatke
Bally B6372.
Ilysanthes pusilla (Oliv.) Urban
Hucks 1044.

252 Scrophulariaceae (*cont.*)

Pseudosopubia sp.
G. & K. 12,875; Hucks 400; 802; Sheldrick B8733.
Rhamphicarpa veronicifolia Vatke
Hucks 372; 381; 478.
Stemodiopsis buchananii Skan
Bally B8800; Verdcourt 3896.
S. humilis Skan
Gillett & Burtt 17,191.
Striga gesnerioides (Willd.) Engl.
Polhill & Paulo 950.
S. latericea Vatke
McArthur 268.

257 Bignoniaceae

Kigelia africana (Lam.) Benth.
G. & K. 12,701; Hucks 737.

258 Pedaliaceae F. T. E. A. (1953)

Josephinia africana Vatke
G. 9768; G. & K. 12,827; Hucks 111.
Pedalium murex L.
Hucks 184; 635; Polhill & Paulo 922.
Pterodiscus ruspolii Engl.
Hucks 715.
Sesamothamnus busseanus Engl.
Sr. G.
S. rivae Engl.
Dale 3877; 10,812; Hucks 319.

259 Acanthaceae

Adhatoda schimperana Nees
Lady Muriel Jex Blake CM. 18128.
Anisotes parvifolius Oliv. (or related species)
Hucks 441; 841; Napier Bax TNP/E/40; Schenkel 39.
Asystasia charmian S. Moore
G. & K. 12,967; Hucks 590; 673.
A. gangetica (L.) T. Anders.
Hucks 823.
A. schimperi T. Anders.
Hucks 206; 649.
A. somalensis (Franch.) Gillett
G. & K. 12,847; Ossent 35.
Asystasia sp.
Hucks 391.
Barleria diffusa (Oliv.) Lindau
Bally B8686; G. & K. 13,016; 13048; Hucks 225; 243; 322;
B. eranthemoides C. B. Cl.
Hucks 684; Rauh Ke 54.
B. ramulosa C. B. Cl.
G. & K. 13046; Hucks 131; 745; Verdcourt 3192.
B. submollis Lindau
Hucks 55; 771; 794; Napier 894; Ossent 78; Agnew et al. 5832.
B. taitensis S. Moore
G. & K. 13070; Hucks 30; 894; Polhill & Paulo 945; Sheldrick TNP/E/142.
Barleria sp. sect. Prionitis.
G. & K. 12922; Napier 896; Ossent 164.
Barleria sp. sect. Prionitis.
Greenway EAH, 12,219; Hucks 36; 169.
Barleria sp. sect. Somalia
G. & K. 12,980.
Barleria sp. sect. Somalia
Bally B8614; Verdcourt 3894.
Barleria sp. sect. Somalia
Hucks 206; Polhill & Paulo 929.
Barleria sp.
Hucks 1070.
Blepharis linariifolia Pers.
Hucks 1051.
B. maderaspatensis (L.) Roth
Hucks 739.
B. fruticulosa C. B. Cl.
Hucks 815.
Blepharis sp.
Agnew 580.
Crabbea velutina S. Moore
Hucks 977.
Crossandra mucronata Lindau
G. 9743; G. & K. 12,659.
C. stenostachya (Lindau) C. B. Cl.
Lunan EAH. 13959.
Dicliptera mossambicensis Klotzsch
Hucks 789.
Disperma kilimandscharica (Lindau) C. B. Cl.
Agnew et al, 5843; Hucks, 306;436;805;852; Napier 897.
Disperma sp.
Hucks 305.
Disperma sp.
Schenkel 57.
Dyschoriste perrotteii (Nees) O. Ktze
Bally B866; Natttrass 208A.

259 Acanthaceae (*cont.*)

Ecbolium amplexicaule S. Moore
G. & K. 12,669; Hucks 96; Joanna 2034.
E. revolutum (Lindau) C. B. Cl.
G. & K. 12,696; Hucks 239; 791; Napier 1096.
Hypoestes hildebrandtii Lindau
G. 9823; Hucks 812.
Justicia caerulea Forsk.
G. & K. 12,968; Hucks 591; 809.
J. flava Vahl
Hucks 768; Napier Bax TNP/E/50.
J. heterocarpa T. Anders.
Hucks 83; 779; Sheldrick & Moore TNP/E/136.
J. sansibarensis Lindau
Ossent 138.
J. uncinulata Oliv.
Hucks 1008.
Justicia sp. aff. *J. striata* (Klotzch) Bullock
Bally B8618; Hucks 49; 69; McDonald 862.
Justicia sp.
Hucks 236.

E. hamatum C. B. Cl.
Hucks 97.
E. subcordatum C. B. Cl.
Hucks 647.
H. verticillaris R. Br.
G. & K. 12,785; Hucks 260;675;797;817
J. fischeri Lindau
Hucks 65lb; 723; Ossent 2.
J. glabra Roxb. forma
Bally B8736; Hucks 751; Napier 1052.
J. matammensis Oliv.
Hucks 369; 608; 866.
J. striata (Klotzch) Bullock
G. & K. 12,782; Hucks 784.
J. whytei S. Moore
Hucks 52; 426; Moore & Sheldrick TNP/E/143;
Justicia sp. aff. *J. odora* Vahl
Napier 1042.

Lepidagathis scariosa Nees
G. 9828; Hucks 45; 136; Napier 985; Polhill & Paulo 944.
Monechma debile (Forsk.) Nees
Hucks 240; 654; 767; Napier 905.
Neuracanthus ukambensis C. B. Cl.
Hucks 337.
Neuracanthus sp.
G. & K. 12,912.

Monechma sp. ?
Hucks 796; 1019.
Neuracanthus sp.
G. & K. 13,032 = Agnew EAH. 13,723;
Hucks 275; 633; 856.

Peristrophe bicalyculata (Retz.) Nees
Hucks 33; Napier 916.
Rhinacanthus nasutus (L.) Kurz
Hucks 339.
Ruellia amabilis S. Moore
Bally B8735; Hucks 602; Ossent 109.
R. patula Jacq.
G. & K. 12,846 = Napier 891; Hucks 138; 380.
Ruttya fruticosa Lindau
Gillett & Burtt 17,185; Hucks 370; Napier 977
Thunbergia holstii Lindau
G. & K. 12,773.
T. guerkeana Lindau
G. & K. 12,818.
Thunbergia sp. nov. = Drummond & Hemsley 4104
G. & K. 12,876.

263 **Verbenaceae**

Chascanum hildebrandtii (Vatke) Gillett
Gillett 17,208; G. & K. 12,915; Hucks 773A.
Clerodendrum eriophyllum Guerke
Bally B7712.
C. makanjanum H. Winkler
G. 9545; Ossent 106; Polhill & Paulo 470.
Cyclocheilon eriantherum (Vatke) Engl.
G. & K. 12,707; Dale 3647; Ossent 127; Verdcourt 3224.
Lantana camara L.
G. & K. 13,009; Hucks 346.
Lantana sp.
G. & K. 12,745; Drummond & Hemsley 4091 named by Kew as *L. viburnoides* (Forsk.) Vahl but these are certainly not this species, another is Hucks 701.
Phyla nodiflora (L.) Greene
G. & K. 12,904; Hucks 33; 110.
Premna hildebrandtii Guerke
Bally B8639; G. & K. 12,990.
P. oligotricha Bak.
Agnew et al 5818; Bally B8626; G. & K. 12,807;
Napier 1066.
P. resinosa (Hochst.) Shauer
G. 12,520; G. & K. 12,688; 12,840; Hucks 311; Napier Bax TNP/E/64.
Priva cordifolia (L.) Druce var. *abyssinica* (Jaub. & Spach) Moldenke
Hucks 773B; 793; Napier 931; Verdcourt 3876.
Svensonia laeta (Walp.) Moldenke
G. & K. 12,886; Verdcourt 1109.
Vitex payos (Lour.) Merr.
G. & K. 12,630.
V. strickeri Vatke & Hildebrandt
Sheldrick TNP/E/R/74.

264 Labiatae

Basilicum polystachion (L.) Moench.
G. & K. 12,981; Hucks 222; 860.
Becium sp.
Hucks 342; 475; 681; 772; Sheldrick & Moore TNP/E/131.
Capitanya otostegioides Guerke
Gillett 17,276; G. & K. 12,957; Hucks 637; 780.
Coleus, some authorities consider that this genus should be sunk in *Plectranthus*.
C. amboinicus Lour.
Bally B8633; B8919.
C. tenuiflorus Vatke
Napier 919.
Coleus sp.
Bally B8653.
Endostemon tenuiflorus (Benth.) Ashby
Hucks 988.
C. ignarius Schweinf.
Napier 1024.
Coleus sp. aff. *C. teitensis* Bak.
Napier 1037.
Coleus sp.
Nattrass B1157.
E. tereticaulis (Poir.) Ashby
G. 10,434; G. & K. 12,681; Hucks 485; 728; Napier 1029.
Erythrochlamys spectabilis Guerke
G. & K. 12,811; 12,829; Hucks 71; 315; Napier 1056.
Hemizygia fischeri (Guerke) Greenway (Syn. *Ocimum fischeri* Guerke.)
G. & K. 12,761; Hucks 266; 607; Verdcourt 3882.
Hoslundia opposita Vahl
G. & K. 12,934; 1067; Hucks 811; Rauh K67.
Iboza multiflora (Benth.) E. A. Bruce
Nattrass 204.
Leonotis nepetifolia L.) R. Br.
Hucks 379.
Leucas neuflizeana Courb.
Hucks 749; 806.
L. oligocephala Hook.f.
Gregory s.n., not seen.
L. nubica Benth.
Hucks 1016.
L. pratensis Vatke
Hucks 484; 502.
Leucas sp.
G. 10,808; G. & K. 12,998; Hucks 577; 847; Napier 1019; the last was named *L. bracteata* Guerke by Kew but is not that species.
Leucas sp.
Hucks 417.
Ocimum basilicum L. (Syn. *O. americanum* L.)
G. & K. 13,024; 13,068; Napier 1002.
Ocimum sp.
Hucks 154; 719.
Orthosiphon sp.
G. & K. 12,970.
Plectranthus barbatus Benth.
Agnew et al. 5807; Nattrass B1158.
P. longipes Bak.
Hucks 270; 697; 732.
O. hadiense Forsk.
G. & K. 12,864; Hucks 8; 666.
Ocimum sp. = Makin 182.
Hucks 1058.
Orthosiphon sp.
Hucks 689.
P. cylindraceus Benth.
Napier 1071.
P. prostratus Guerke
Greemsmith CM16,236.
Pycnostachys umbrosa (Vatke) Perkins
Hucks 374.
Tinnea aethiopica Kotschy & Peyr.
G. & K. 13,029; Hucks 515; Rauh 12,506.

II MONOCOTYLEDONES

I Calyciferae

(Families Nos. 266—290).

266 Hydrocharitaceae

Lagarosiphon tenuis Rendle
Gregory sn. type not seen; Napier Bax TNP/Gs/8.

279 Najadaceae

Najas graminea Delile e desc.
G. & K. 13,060.

280 Commelinaceae

Aneilema hockii De Wild.
Hucks 617B; 221; Napier 915.
A. petersii (Hassk.) C. B. Cl.
Napier 973.
A. johnstonii K. Schum.
Hucks 519.
A. rendlei C. B. Cl.
Hucks 15; 690; Napier 914; Verdcourt 3901.

280 Commelinaceae (*cont.*)

Aneilema sp. = Bally B8534.
Bally B8534; Hucks 669.
Anthericopsis sepalosa (C. B. Cl.) Rendle
G. & K. 12,733; Hucks 465; 493.
Ballya zebrina (Chiov.) Brenan
Verdcourt 3892.
Commelina albescens Hassk.
Hucks 1069.
C. benghalensis L.
Agnew et al. 5816; Hucks 646; Lucas et al. 270; Napier 908.
C. erecta L. ssp. *livingstonii* (C. B. Cl.) J. K. Morton
Hucks 551.
C. forskalaei Vahl
G. & K. 12,790; Hucks 715A; 716B; 769; Verdcourt 3899.
C. imberbis Hassk.
Hucks 634; 703.
C. latifolia Hochst.
Napier 913.
C. ?petersii Hassk.
Hucks 617A; 655; Lucas et al. 271; Napier Bax TNP/E/44; Napier 907.
C. subulata Roth, Fl. Trop. Afr. 8: 38 (1901).
Gregory sn., not seen.

290 Zingiberiaceae

Kaempferia aethiopica (Solms-Laub.) Benth.
G. 9503; Hucks 508.

II Corolliferae

(Families Nos. 293—326).

293 Liliaceae.

Albuca wakefieldii Bak.
G. & K. 12,953; Hucks 585; Ossent 22.
Aloe deserti Berger
Bally B8652; Ossent 99.
A. lateritia Engl.
Sr. G.
A. ruspoliana Bak.
G. & K. 13,086; Bally B8791.
A. secundiflora Engl.
Sr. G.
Aloe sp. aff. *A. ruspoliana* Bak.
G. & K. EAH. 13,728.
Anthericum brehmerianum Poelln.
Hucks 536.
A. suffruticosum (Bak.) Milne-Redhead
G. & K. 12,918; Hucks 477.
Anthrecum sp.
G. & K. 12,718.
Asparagus asiaticus L.
Schenkel 32.
A. falcatus L.
Schenkel 34.
A. ?nudicaulis Bak.
Hucks 450.
Chlorophytum gallabatense Bak.
Hucks 906.
C. tenuifolium Bak.
G. & K. 12,736; Hucks 477.
C. tuberosum Bak.
Hucks 520.
C. viridescens Engl.
G. & K. 12,966; Hucks 597; Sheldrick B8795.
Dasystachys debilis Bak. (Syn. *D. gracilis* Bak.; *Chlorophytum bakeri* von Poelln.)
G. & K. 12,710; Hucks 546; Ossent 139.
Dipcadi viride Moench.
Hucks 925.
Drimiopsis sp. = G. & K. 11,105
G. & K. 12,854; Hucks 494.
Gloriosa abyssinica A. Rich. var. *graminifolia* Franch.
Jeffrey K814.
G. simplex L.
Bally B8166; Dale K204; Hucks 553;
Ornithogalum donaldsonii (Rendle) Greenway (Syn. *Albuca donaldsonii* Rendle)
G. & K. 12,895; Hucks 594; Ossent 21.
Scilla kirkii Bak.
Hucks 523.
Urginea sp. aff. *U. indica* Kunth
G. & K. 12,975; 13,030.

302 Araceae

Amorphophallus gallaensis (Engl.) N. E. Br.
G. & K. 12,689; Hucks 300; Oxford sn.
A. gregoryana Engl. & Gehrm.
Gregory sn. type, Mtito Andei, not seen.
Stylochiton angustifolius A. Peter e desc. & Fig.
Greenway EAH. 12,523; G. & K. 12,725; 12,751; Sheldrick B8731.
S. salaamicus N. E. Br.
Greenway EAH. 12,710; G. & K. 12,724.

305 Typhaceae

Typha domingensis Pers.
G. & K. 13,050 fide Kew.

306 Amaryllidaceae

Ammocharis tinneana (Kotschy & Peyr.) Milne-Redhead & Schweich.
Hucks 463.
Crinum kirkii Bak.
Hucks 464.
Crinum sp.
Beecher H345/63/1.
Crinum sp.
Greenway EAH. 12,200.
Cryptostephanus haemanthoides Pax
G. & K. 12,853; G. & K. EAH. 13,725; Ossent 265.
Haemanthus multiflorus Martyn
Hucks 446.
Pancratium trianthum Herb.
Hucks 261; 648.

307 Iridaceae

Acidanthera candida Rendle
Hucks 603.

313 Agavaceae

N. E. Br. in *Kew Bull.* **1915**: 198.

Sansevieria arborescens Gerome & Labroy
Powell 4.
S. caulescens N. E. Br. lc. p. 200.
Powell sn., Voi or Taru but exact locality uncertain.
S. ehrenbergiana Bak. (Syn. *S. robusta* N.E. Br. lc. p. 207).
Grenfell 6; 13; 18; Powell sn.; Bally B8651; Hucks 706; Napier Bax TNP/E/56.
S. intermedia N. E. Br. lc. p. 211, f. 6.
Powell 9.
S. powellii N. E. Br. lc. p. 198, f. 1.
Powell 5; Bally B7785.
S. singularis N. E. Br. lc. p. 222.
Powell 2; G. & K. 13,056; Sheldrick B8592; Bally 8592
Sansevieria sp.
Hucks sn.

314 Palmae

Hyphaene coriacea Gaertn.
Sr. G.

319 Velloziaceae

Vellozia aequatorialis Rendle
Hucks 470; Napier 1342; Verdcourt & Polhill 2697.

326 Orchidaceae F.T.E.A. (1, 1968).

Eulophia orthoplectra (Reichb. f.) Summerhayes
Hucks 564; Napier 1038.
E. petersii Reichb. f.
Drummond & Hemsley 4232.
E. wakefieldii (Reichb. f. & S. Moore) Summerhayes
G. & K. EAH. 13,727.
Habenaria ndiana Rendle, Fl. Trop. Afr. 7: 239 (1898).
Gregory sn. type, not seen.
Vanilla roscheri Reichb. f.
G. 10,818; Hucks 456.

III Glumiflorae

(Families Nos. 327–332)

331 Cyperaceae

Kukenthal, G. In Engler, A, & Diels, L. *Das Pflanzenreich*, IV, 20, 4, Cyperaceae 1935, Leipzig.
Napper, D. M. Cyperaceae of East Africa I-IV- *Journ. E.A. Nat His Soc.* **24**: 2&5; **25**: 1; **26**: 1-1963-1966-Nairobi.

Bulbostylis sp = Bagenal 4636.
G. & K. 12,770; 12,949.

331 Cyperaceae (*cont.*)

Coelochloa setifera (Ridley) Gilly
Polhill & Paulo 947.
Cyperus alternifolius L. ssp. *flabelliformis* (Rottb.) Kukenth.
Sr. G.; Napier Bax TNP/E/21.
C. articulatus L.
G. & K. 12,758; Napier Bax TNP/E/20; Sheldrick & Moore TNP/E/148.
C. compressus L.
G. & K. 12,873.
C. distans L. f.
G. & K. 13,001.
C. giolii Chiov.
G. & K. 12,716; Hucks 575.
C. grandibulbosus C. B. Cl. in Engl. A., Pflanzr. Cyperaceae-Scirpoid.—Cyperac. IV, 20: 125 (1935).
Scott Elliot 6284 ex num. not seen.
C. immensus C. Cl. var. *taylori* C. B. Cl.
G. & K. 13,052; Napier Bax TNP/E/23.
C. kaessneri C. B. Cl.
G. 10,467.
C. laevigatus L.
G. & K. 13,039.
C. longus L. ssp. *tenuiflorus* (Rottb.) Kukenth.
G. & K. 13,040.
C. maculatus Boeck.
G. & K. 13,004.
C. obtusiflorus Vahl
G. & K. 12,788.
Fimbristylis bisumbellata (Forsk.) Bub.
G. & K. 13,006; 13,033.
F. exilis (H.B.K.) Roem. & Schult.
G. & K. 12,978.
Kyllinga alba Nees
G. & K. 12,743; Hucks 357.
K. triceps Rottb. var. *obtusiflora* Boeck.
G. & K. 12,804.
Lipocarpha chinensis (Osb.) Kern
G. & K. 13,036.
Mariscus aristatus (Rottb.) Cherm.
G. 10,469.
M. leptophyllus (Hochst.) C. B. Cl.
G. & K. 12,802.
M. mollipes C. B. Cl.
Bogdan 3626.
M. obsoletenervosus (A. Peter & Kukenth.) Greenway
G. & K. 12,651.
M. taylori C. B. Cl.
G. & K. 12,775.
M. taylori C. B. Cl. var. *taylori*
Bogdan 3625; Drummond & Hemsley 4097.
Mariscus sp.
Agnew et al. 5829; G. & K. 12,662.

332 **Gramineae**

Bogdan A.V., A Revised List of Kenya Grasses, 2nd. ed. (1958), Nairobi.
Napper, D.M., Grasses of Tanganyika (1965), Dar-es-Salaam.
Acrachne racemosa (Roem. & Schult.) Ohwi
Sheldrick TNP/Gs/29.
Andropogon schinzii Hack.
Greenway 9771; G. & K. 12,976; Napper 1341; Sheldrick 101.
Aristida adscensionis L.
Greenway 9773; Polhill & Paulo 941.
A. barbicollis Trin. & Rupr.
G. 9770; G. & K. 12,809; 12,928.
A. coerulescens Desf.
Gregory s.n. not seen. Possibly a mis-identification as this species is not recorded in Kenya. It is, I think, *A. adscensionis* L.
A. mutabilis Trin. & Rupr.
G. & K. 12,926.
A. stenostachys W. D. Clayton
Bogdan 5322; G. 9769.
Bothriochloa radicans (Lehm.) A. Camus
G. 9776; G. & K. 12,900; Sheldrick 104.
Brachiaria deflexa (Schumach.) Robyns
Sheldrick TNP/E/4.
B. eruciformis (J. E. Sm.) Griseb.
G. 9783; G. & K. 12,969; Sheldrick 111.
B. lachnantha (Hochst.) Stapf
Sheldrick 106.
B. leersioides (Hochst.) Stapf
Bally B8643; G. & K. 12,795; Napier Bax TNP/E/13a.
B. leucacrantha (K. Schum.) Stapf
Bogdan 5679; G. 9774; Sheldrick NP/7.
B. nigropedata (Munro) Stapf
Rauh Ke957.
B. serrifolia (Hochst.) Stapf
Bogdan 5681; Sheldrick TNP/E/120.
Brachiaria sp. = Greenway 9782.
G. 9782 fide Kew; G. & K. 12,717.
Cenchrus ciliaris L.
Bally B8645; G. & K. 12,631; MacDonald 835; Napier Bax TNP/E/45; Sheldrick 115.
C. setigerus Vahl
G. & K. 12,644.
Chloris barbata Sw.
G. & K. 12,874.
C. gayana Kunth
Rauh Ke951; 951a.

332 **Gramineae** (*cont.*)

Chloris roxburghiana Schult.
G. & K. 12,636; MacDonald 850; Trapnell 2226.
Chrysopogon aucheri (Boiss.) Stapf var. *quinqueplumis* (A. Rich.) Stapf
G. & K. 12,877; Sheldrick 107; Verdcourt 3898.
Coix lacryma-jobi L.
MacDonald 864; Napier 998.
Cymbopogon pospischilii (K. Schum.) C. E. Hubb.
G. & K. 12,881; Sheldrick NP/15.
Cynodon dactylon (L.) Pers.
G. & K. 12,667; 13,072; Sheldrick & Moore TNP/E/156.
C. plectostachyus (K. Schum.) Pilger
Sheldrick & Moore TNP/E/129.
Dactyloctenium aegyptium (L.) Beauv.
Bally B8644; Sheldrick TNP/E/11.
D. giganteum Fischer & Schweickt.
G. & K. 12,959; Sheldrick TNP/E/11.
D. scindicum Boiss.
G. & K. 13,045.
Dactyloctenium sp.
G. & K. 12,738.
Digitaria aridicola Napper
Sheldrick EAH. 12,507; 110; EAH; 12,506 type.
D. macroblephara (Hack.) Stapf
Bogdan 3527; G.9775; G. & K. 12,787; 13,015.
D. milanjiana (Rendle) Stapf
G. & K. 12,974.
D. pennata (Hochst.) T. Cooke
Bogdan 5690; G. & K. 12,884; Verdcourt 3884
D. rivae (Chiov.) Stapf
G. & K. 12,796; 12,879; Sheldrick NP/21.
D. velutina (Forsk.) Beauv.
(Syn. *Panicum fenestratum* A. Rich.)
Gregory sn.,
Diplachne caudata K. Schum.
G. & K. 12,759.
Echinochloa haploclada (Stapf) Stapf
G. & K. 12,670; 12,983; 12,999; Sheldrick TNP/E/121; Sheldrick & Moore TNP/E/149.
Eleusine indica (L.) Gaertn.
Bogdan 5700.
Enneapogon cenchroides (Roem. & Schult.) C. E. Hubb.
G. & K. 12,914.
E. elegans (Nees) Stapf
G. & K. 12,878.
Enteropogon macrostachyus (A. Rich.) Benth.
G. & K. 12,632; Sheldrick 109; TNP/E/95; Verdcourt 2698.
E. rupestris (J. A. Schmidt) A. Chev.
(Syn. *E. somalensis* Chiov.)
Bogdan 3613; G. & K. 12,833.
Eragrostiella bifaria (Vahl) Bor
Bogdan 5684; Sheldrick 102; 103.
Eragrostis aethiopica Chiov.
Greenway 9779; G. & K. 13,064.
E. aspera (Jacq.) Nees
MacDonald 837.
E. caespitosa Chiov.
G. & K. 12,806; Sheldrick NP/8; Verdcourt 2691.
E. cilianensis Lutati
Disney 58/7; Sheldrick 116; G. Williams 835.
E. ciliaris (L.) R. Br.
G. & K. 12,742; MacDonald 853.
E. ciliaris (L.) R. Br. var. *brachystachya* Boiss.
G. 10,470; G. & K. 12,742.
E. exasperata A. Peter
G. & K. 12,929.
E. horizontalis A. Peter
Bogdan 3899; G. & K. 12,872; 12,960.
E. superba Peyr.
G. & K. 12,903; MacDonald 833.
Eriochloa nubica (Steud.) Thell.
G. & K. 12,985.
Eulalia sp. aff. *E. ferruginea* Stapf
G. & K. 12,920.
Eustachys paspaloides (Vahl) Lanza & Mattei
Sheldrick TNP/Gs/28.
Hemarthria natans Stapf
G. & K. 12,870.
Heteropogon contortus (L.) Roem. & Schult.
Bogdan 5685; G. & K. 12,925.
Holcolemma canaliculatus (Nees) Stapf & C.E. Hubb.
Parker GM99G.
Hyparrhenia filipendula (Hochst.) Stapf var. *pilosa* (Hack.) Stapf
G. & K. 13,006.
Ischaemum afrum (J. F. Gmel.) Dandy
G. & K. 12,794.
Latipes senegalensis Kunth
Bogdan 3624; G. & K. 12,799; Rauh Ke41; Tateoka 3110.
Leersia hexandra Sw.
G. & K. 12,868.

332 **Gramineae** (*cont.*)

Leptocarydion vulpiastrum (De Not.) Stapf
Bally B8921; MacDonald 860.
Leptochloa obtusiflora Hochst.
G. & K. 12,723; 12,836.
Oropetium thomaeum (L. f.) Trin.
G. 9784 fide Kew.
Panicum chusqueoides Hack.
Parker EAH. 12,796.
P. deustum Thunb.
Bogdan 5323; Napier Bax TNP/E/32.
P. infestum Anderss.
Bogdan 5382; G. & K. 12,726; 12,898.
P. meyerianum Nees
G. & K. 12,866.
P. repens L.
G. & K. 12,869.
Paspalidium geminatum (Forsk.) Stapf
G. & K. 12,643.
Paspalum vaginatum Sw.
G. & K. 12,867.
Pennisetum massaicum Stapf
Bogdan 3614; G. & K. 12,834.
Perotis patens Gand.
G. & K. 12,930.
Phragmites karka (Retz.) Steud.
Heady 1668.
Rhynchelytrum repens (Willd.) C. E. Hubb.
G. & K. 12,972.
Schmidtia bulbosa Stapf
G. & K. 12,642; 12,646; 12,849.
Schoenefeldia transiens (Pilg.) Chiov.
G. 9781; G. & K. 12,793.
Setaria pallidefusca (Schumach.) Stapf
G. & K. 12,977.
Sorghum brevicarinatum Snowden var. *swahelorum* Snowden
MacDonald 852.
Sporobolus festivus A. Rich.
G. & K. 12,741.
S. gemiratus W. D. Clayton
G. & K. 12,753; 13,073, type.
S. pellucidus Hochst.
G. & K. 12,772.
S. virginicus (L.) Kunth
G. & K. 13,038.
Stipagrostis hirtigluma (Trin. & Rupr.) De Winter (Syn. *Aristida hirtigluma* Trin. & Rupr.)
G. & K. 12,913.
S. uniplumis (Licht.) De Winter (Syn. *Aristida papposa* Trin. & Rupr.)
G. & K. 12,927.
Tetrachaete elionuroides Chiov.
G. & K. 12,882; Parker GM64G; EAH 12,802.
Tetrapogon bidentatus Pilg.
Bogdan 3903; 5321; G. & K. 12,638; 12,778; Sheldrick NP/17.
T. tenellus (Roxb.) Chiov.
G. 10,430; G. & K. 12,883; Sheldrick & Moore TNP/E/157.
Tragus berteronianus Schult.
Bally B8642; G. & K. 12,808.
Tricholaena eichingeri (Mez) Stapf & C. E. Hubb.
G. & K. 12,856.
Urochloa sclerochlaena Chiarugi
Bogdan 5680; Parker 28.

L. ?panicea (Retz.) Ohwi
Sheldrick 112.
Oropetium sp.
Verdcourt & Polhill 2703; G. & K. 12,766.
P. coloratum L.
Bogdan 5686; G. & K. 12,787.
P. heterostachyum Hack.
Napier 938.
P. maximum Jacq.
G. & K. 12,765; 12,784; Sheldrick TNP/E/98a.

Panicum sp. nov.=Phipps 412.
G. & K. 12,678.

P. mezianum Leeke
Sheldrick 105

P. mauritianus Kunth
G. & K. 12,910.
R. villosum (Parl.) Chiov.
Bogdan 3915; G. & K. 12,950; Sheldrick 117.

S. verticilliflorum (Steud.) Stapf
Sheldrick TNP/E/122.
S. helvolus (Trin.) Dur. & Schinz
G. & K. 12,675; 12,835 (young stage); 13,000.

S. spicatus (Vahl) Kunth
G. & K. 12,695.

T. cenchriformis (A. Rich.) Clayton
Sheldrick 118.

NAME CHANGES

Hemezygia fischeri (Guerke) Greenway comb. nov., Labiatae, Syn. *Ocimum fischeri* Guerke in *Engl. Bot. Jahrb.* **91**: 195 (1894), *Fischer* 501, type.

Mariscus obsoletenervosus (A. Peter & Kukenth.) Greenway comb. nov., Cyperaceae, Syn. *Cyperus obsoletenervosus* A. Peter & Kukenth. in Engl. & Diels Das Pflanzenreich, Cyperaceae- Sceopoedeae-Cypereae, **4**, 20, 4: 548 (1936), *A. Peter* 13, 348: **10**,723, types.

Ornithogalum donaldsonii (Rendle) Greenway comb. nov. Liliaceae, Syn. *Albuca donaldsonii* Rendle in *Journ. Bot.* **1896**: 131, *Donaldson Smith* sn. type.

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INDEX

to Families and Genera

Numbers are those of the families in the list. Ferns, Fungi and Lichens are at the beginning of the list.

(Received 3rd February, 1968)

NOTES ON SOME BUTTERFLIES OF THE NGARA DISTRICT OF TANZANIA WITH A LIST OF THOSE RECORDED

By

L. A. Haldane

The following notes are based on a small collection made in 1948 and 1949 and vegetational and faunal changes may well have occurred since then. Collecting was undertaken only sporadically and as opportunity offered and achieved a far from complete record of butterflies in the area, Lycaenids and Hesperiids in particular being poorly represented. Sufficient species were however taken to give a fair indication of relationships with adjoining areas. A few records are, I think, new to the Tanzania list.

The Ngara district, with an area of 1,045 sq. miles, lies between fifty and eighty miles to the west of the southern end of Lake Victoria. The altitude varies from 4,200 to 6,000 feet a.s.l. and the rainfall, which occurs mainly between October and April, averages about forty inches a year.

The country falls into five main zones:

HIGHLANDS: These lie between 5,500 and 6,000 feet a.s.l., mostly in the form of ridges on a SW/NE axis, outliers to the main body of the Burundi uplands. These ridges are generally open and grass-covered but with patches of stunted thorn and other trees. *Antanartia abyssinica* Fld., *Colias electo* L. and *Pontia helice johnstoni* Crowley occur here. In Bugufi in the north, this zone is heavily populated. Extensive plantations of bananas and coffee intermingled with figs and other trees have given shelter to indigenous vegetation which has been burned off elsewhere. As a result many forest margin species from the next zone are encountered here as well as the usual open country populations.

MIDDLE LEVELS: The greater part of the district lies between 4,500 and 5,500 feet and is covered with trees, more or less thickly distributed, with a strong growth of tall grass, annually burned, below. Small pockets of evergreen forest remain here and there and narrow and discontinuous strips of fringing forest in some of the valleys extend through many parts of this zone. While therefore the population is mainly that of open or sylvan country the denser areas support such forest-margin species as *Tirumala limniace petiverana* Dbl. & Hew., *Amauris n. niavius* L., *Acraea z. zetes* L., *Acraea a. asboloplintha* Karsch, *A. s. sotikensis* E. Shpe., *A. p. perenna* Dbl. & Hew., *A. johnstoni butleri* Aur., *Charaxes c. castor* Cr., *Ch. p. pollux* Cr., *Ch. dilutus* Rths., *Ch. etheocles ochracea* Roths., *Precis natalica* Fld., *Asterope garega* Karsch, *Vannessula milca latifasciata* Tbt., *Pentila p. peucetia* Hew., *Appias epaphia orbona* Bsd., *Mylothris poppea* Cr., *Nepheronia argia varia* Trim., *Papilio d. dardanus* Brown, *P. phorcas congoanus* Rths., *P. bromius chrapkowskoides* Storace, *P. nireus lyaeus* Dbl., and *Graphium ridleyanus* White.

SWAMPS: Many of the broader valleys in both the above zones contain perenially wet grasslands shading into marsh. Here *Acraea acerata* Hew., *A. ventura* Hew., *Catacroptera cloanthe* Cr., *Precis ceryne* Bsd., *Mylothris bernice rubricosta* Mab. *Eurema hapale* Mab. and *Metisella midas* Btl. occur.

LOWLAND FOREST: The deep gorge of the Ruvuvu river cuts through the district at just over 4,000 feet and along its length, and along the lower reaches of some of its tributaries, small stretches of evergreen forest are to be found where plentiful groundwater supplements the rainfall. The greatest extent of forest occurs at the Russumo Falls in the north-east of the district just below the juction of the Ruvuvu and Kagera rivers. This latter forms part of the northern boundary of the district

and flows through a broad belt of papyrus from which the occasional forested island rises a few feet above the level of the swamp. A very brief visit to this zone produced *Amauris t. tartarea* Mab., *Bamatistes quadricolor latifasciata* E. Shpe., *Bematistes p. poggei* Dew., *Acraea e. egina* Cr., *Precis westermanni* West., *Abisara rogersi* Druce and *Papilio zoroastres joiceyi* Gab.

PLAINS: In the south-eastern corner the country falls a few hundred feet, but fairly sharply, to form part of the vast sylvan area which runs south from Lake Victoria through western Tanzania. Among the larger species *Charaxes guderiana* Dew., *Ch. ethalion* Bsd., *Graphium policenes* Cr. and *G. antheus* Cr. are typical.

GEOGRAPHICAL DISTRIBUTION

The district forms part of the transitional area between the plains of western Tanzania and the high country which runs north through Burundi and Rwanda to Kabale and the Ruwenzoris in western Uganda. As with the birds[1] affinities are predominantly East African. Some 92 out of 146 species identified from Ngara occur in the same races and forms in Rhodesia.[2] While 28 of these are fairly ubiquitous Ethiopian species, in the main they are typical of the sylvan area which extends a thousand miles southwards from Lake Victoria.

Of the remaining species one group is found particularly on the northern and western edges of this area, distributed from Angola through Burundi, Rwanda, Uganda, Kenya west of the Rift Valley, and as far as Abyssinia in some instances. Ngara representatives of this group include *Acraea e. egina* Cr., *A. natalica abadima* Ribbe, *A. s. sotikensis* E. Shpe., *A. ventura* Hew., *Charaxes dilutus* Rths., *Precis sophia infracta* Btl., *Bicyclus vulgaris* Btl., *Neocoenyra cooksoni* Ham., *Belenois rubrosignata* Weym., *Colotis eucharis evarne* Klug, *C. aurigineus* Btl., *C. hetaera* Gerst., and *Metisella midas* Btl. Of more limited distribution within this area, being largely confined to western Kenya, Uganda and north-western Tanzania are *Bematistes quadricolor latefasciata* E. Shpe., *Acraea a. asboloplintha* Karsch, *Bicyclus saussurei* Drury, *P. bromius chrapkowskoides* Storace, and *P. zoroastres joiceyi* Gab.

West African influences are seen from the following which are found from Senegal to the Congo and Uganda. *Amauris n. niavius* L., *A. t. tartarea* Mab., *Bematistes p. poggei* Dew., *Acraea z. zetes* L., *A. p. perenna* Dbl. & Hew., *A. johnstoni butleri* Aur., *Charaxes c. castor* Cr., *Ch. p. pollux* Cr., *Precis wetsermanni* West., *Vanessula milca latifasciata* Tbt., *Bicyclus campa* Karsch, *Abisara rogersi* Druce, *Anthene crawshayi* Btl., *Mylothris poppea* Cr., *Belenois theora lortzingi* Suff., *Papilio d. dardanus* Brown, *P. phorcas congoanus* Rths., and *Graphium ridleyanus* White. Again West African, from the Cameroons to Uganda and Abyssinia, are *Asterope garega* Karsch, *Ariande pagenstecheri* Suff., *Precis pelarga* Fab., *Belenois subeida* Feld., *Belenois solilucis* Btl. and *Leptosia medusa* Cr.

The butterfly population of the more open formations is chiefly that of the southern sylvan zone[3] represented by 67 out of 89 species with, for example, *Graphium pylades* represented by the eastern and southern race *angolanus* Goeze rather than by race *pylades* Fab. which occurs in what are comparatively nearby regions of Uganda. Butterflies associated with forests or forest margins show affinities with the western lowland forest zone[3], some 32 out of 47. Many of these occur also on Ukerewe Island off the Bukoba shores of Lake Victoria, though *Bematistes p. nelsoni* Sm. & Kby. which occurs there[4] is replaced by the Congolese race *poggei* Dew. in Ngara. In general the picture seems to be one of a withdrawal of the forests towards the Congo basin with butterflies of the open formations pressing in from the south and east to fill the gap. Meanwhile the western forest species seem likely to have an increasingly precarious future to look forward to, reliant as they are on the tenuous thread of forests along the river valleys.

LIST OF BUTTERFLIES RECORDED IN THE NGARA DISTRICT

DANAIDAE

Danaus chrysippus L., *Tirumala limniace petiverana* Dbl. & Hew., *Amauris n. niavius* L., *Amauris t. tartarea Mab.*

ACRAEIDAE

Bematistes quadricolor latifasciata E. Shpe., *B.p. poggei* Dew., *Acraea z. zetes* L., *A. e. egina* Cr. & f. *harrisoni* E. Shpe., *A. natalica abadima* Ribbe, *A. asboloplintha asboloplintha* Karsch, *A. encedon* L., *A. s. sotikensis* E. Shpe., *A. cabira* Hpff. *A. acerata* Hew., *A. eponina* Cr., *A. ventura* Hew., *A. p. perenna* Dbl. & Hew., *A. johnstoni butleri* Aur.

NYMPHALIDAE

Charaxes varanes vologeses Mab., *Ch. candiope* Gdt., *Ch. c. castor* Cr., *Ch. p. pollux* Cr., *Ch. dilutus* Rths., *Ch. achaemenes* Fld., *Ch. guderiana* Dew., *Ch. viola kirki* Btl., *Ch. viola vansoni* van Som. & J., *Ch. etheocles ochracea* Roths., *Ch. ethalion* Bsd., *Crenidomimas concordia* Hpff., *Hamanumida daedalus* Fab., *Aterica galene* Brown, *Neptis saclava marpessa* Hpff., *N. jordani* Neave, *N. laeta* Over., *N. lativittata* Over., *N. alta* Over., *Asterope moranti dubiosa* Strd., *A. boisduvali* Wall., *A. garega* Karsch, *Byblia acheloia* Wall., *Ariadne pagenstecheri* Suff., *Neptidopsis ophione velleda* Mab., *Eurytela dryope* Cr., *Hypolimnas misippus* L., *Salamis parhassus aethiops* de Beauv., *Catacroptera cloanthe* Cr., *Precis artaxia* Hew., *P. natalica* Fld., *P. terea elgiva* Hew., *P. archesia* Cr., *P. tugela* Trim., *Precis actia* Dist., *P. perlarga* Fab., *P. ceryne* Bsd., *P. antilope* Feist., *P. o. octavia* Cr., *P. sophia infracta* Btl. & f. *albida* Suff., *P. westermanni* West., *P. oenone* L., *P. hierta* Fab. *P. orithya madagascariensis* Guen., *Vanessula milca latifasciata* Tbt., *Vanessa cardui* L., *Antanartia abyssinica* Fld., *Phalanta columbina* Cr., *P. phalantha* Dr.,

SATYRIDAE

Melanitis leda Dry., *Gnophodes parmeno diversa* Btl., *Bicyclus safitza* West., *B. campa* Karsch, *B. vulgaris* Btl., *B. angulosus* Btl., *B. saussurei* Dry., *Henotesia perspicua* Trim., *Neocoenyra gregorii* Btl., *N. cooksoni* Hamltn., *Ypthima asterope* Klug, *Y. impura* Elw. & Edw., *Y. albida* Btl.

RIODINIDAE

Abisara rogersi Druce.

LYCAENIDAE

Ornipholidotos peucetia peucetia Hew., *Lachnonecma bibulus* Fab., *Virachola antalus* Hpff., *Hypolycaena philippus* Fab., *H. buxtoni* Hew., *Spindasis mozambica* Bert., *Axiocerses harpax* Fab., *Anthene crawshayi* Btl., *A. definita* Btl., *Syntaracus telicanus* Lang.

PIERIDAE

Appias epaphia orbona Bsd., *Belenois gidica* Gdt., *B. creona* Cr., *B. aurota* Fab., *B. zochalia* f. *tanganyikae* Lanz, *B. rubrosignata* Weym., *B. subeida* Feld., *B. theora lortzingi* Suff., *B. solilucis* Btl., *Dixeia orobona vidua* Btl., *D. pigea* Bsd. & f. *rubrobasalis* Lanz, *Mylothris chloris agathina* Cr., *M. poppea* Cr. f. *tirikensis* Neave, *M. bernice rubricosta* Mab., *Leptosia medusa* Cr., *L. alcesta* Stoll., *Pontia helice johnstoni* Crowley, *Pinacopteryx eriphia* Gdt., *Colotis aurigineus* Btl., *C. hetaera* Gerst., *C. danae* Fab., *C. eucharis evarne* Klug, *C. antevippe* Bsd., *C. evagore antigone* Bsd., *C. eris* Klug, *Eronia cleodora* f. *erxia* Hew., *E. leda* Bsd., *Nepheronia thalassina* Bsd., *N. argia varia* Trim., *Colias electo* L. & f. *aurivilliusi* Kef., *Catopsilia florella* Fab., *Eurema hecabe* L., *E. brigitta* Cr., *E. hapale* Mab., *E. desjardinsi* Bsd.

PAPILIONIDAE

Papilio d. dardanus Brown, *P. phorcas congoanus* Rths., *P. bromius chrapkowskoides* Storace, *P. nireus lyaeus* Dbl., *P. demodocus* Esper, *P. zoroastres joiceyi* Gab., *Graphium pylades angolanus* Goeze, *G. ridleyanus* White, *G. leonidas* Fab., *G. policenes* Cr., *G. antheus* Cr.,

HESPERIIDAE

Tagiades flesus Fab., *Eretis lugens* Rog., *Abantis zambesiaca* West., *Spialia dromus* Plötz, *Metisella midas* Btl., *M. orientalis* Aur., *Ampittia capenas* Hew., *Kedestes mohozutza* Wall,, *Borbo mathias* Fab.

ACKNOWLEDGEMENTS

I am most grateful to Mr. T. G. Howarth of the British Museum (Natural History) for considerable help with determinations.

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(*Received 1st July, 1968*)

GEOCARPY AS AN ADAPTATION TO AFROALPINE SOLIFLUCTION SOILS

By

A. D. Q. Agnew & O. Hedberg

INTRODUCTION

One of us (Hedberg, 1964) has given a comprehensive account of the ecology of Afroalpine plants, without any specific mention of geocarpy as an adaptation to the constant solifluction that may be experienced throughout the year in certain habitats. Since the publication of this account, the present two authors have revisited high altitude vegetation in East Africa and the purpose of this paper is to draw attention to the phenomenon and to remark on the species that show it and their ecology.

GEOCARPY AS AN ADAPTATION

Hedberg (1964, pp. 29-33 and 64-70) has outlined the features of solifluction soils, and so it is unnecessary to say more here than that they are intermittently moist soils exposed to rapid changes between mild day- and low night-temperatures. The resultant ice formation, and frost-heaving of the soil surface, often occurring every 24 hours, renders the soil surface extremely mobile and unstable. The plants which can grow in such a habitat must be adapted to it, and the adaptations already noted include tough rhizomes and/or roots, the formation of a "bunch" (i.e. tussock or cushion) of strong stems at ground level and the bizarre "free-living" mosses and lichens which are not attached to the soil at all.

Clearly, establishment of seedlings must be extremely difficult in such a habitat, for before the young roots have penetrated the mobile surface layer of the soil and got anchored below it they are usually pulled out by frost-heaving. This then, is a critical phase in the life-history of these afroalpine plants and it is not surprising that many of them have developed *geocarpy* as a means of adapting to it. Geocarpy means burial of the fruit while still attached to the plant, and it is usually accomplished by bending the pedicel or peduncle down into the soil.

Geocarpic plants of solifluction soils are low, mostly perennial, with a rosette or creeping habit and tough roots. From our observations it seems that some species are strongly geocarpic, while others show this feature only weakly.

Strongly geocarpic afro-alpines so far noted are:

Haplocarpha rueppellii (Sch. Bip.) Beauv.
Haplosciadium abyssinicum Hochst.
Limosella africana Gluck
L. macrantha R. E. Fr.
Ranunculus cryptanthus Milne-Redhead & Turrill
R. oreophytus Del.
R. stagnalis A. Rich.

Several other species tend towards geocarpy in that their pedicels are often reflexed at maturity bringing the fruits into the region of the soil surface and often in contact with the latter, though they are not actively buried. According to a terminology coined by Hylander (1929 p. 211) these may be called *depositors*—their fruits are deposited on the soil surface. On active solifluction soil such fruits may sometimes get buried by soil movements before they are detached from the plant or the seeds are

released, so that the distinction between depositors and truly geocarpic plants may become vague in this case.

The following species have been found by us to behave usually as depositors:

Alchemilla microbetula Th. Fr. jr.
A. subnivalis E. G. Bak.
Anagallis serpens DC. ssp. *meyeri-johannis* (Engl.) P. Tayl.
Lobelia duriprati Th. Fr. jr.
L. lindblomii Mildbr.
L. minutula Engl.
Oreophyton falcatum (A. Rich.) O. E. Schulz
Ranunculus volkensii Engl.
Trifolium acaule A. Rich.
T. elgonense Gillett
Uebelinia crassifolia Th. Fr. jr.
Veronica gunae Engl.

These are all plants of open soils, sometimes found at roadsides and in muddy hollows between tussocks at lower altitudes on the mountains, and occupying the solifluction soils where these exist. Other plants which grow in such soils are those with a densely tufted habit such as *Agrostis sclerophylla* C. E. Hubb., *Cotula cryptocephala* A. Rich., *Myosotis keniensis* Th. Fr. jr., *Sagina afroalpina* Hedb., and *Swertia subnivalis* Th. Fr. jr.

We still do not know how *Subularia monticola* Schweinf. subsists on its permanently moist localities with almost nightly frost-heaving (see Hedberg 1964, p. 66), with no fruit burial or other apparent adaptation.

The necessity of maintaining active growth under conditions of diurnal alternate freezing and thawing, throughout the year, is responsible for most of the special features of the Afroalpine vegetation. This short note merely records one more.

SUMMARY

A record is made of 7 strongly geocarpic herbs and of 12 other species which are weakly geocarpic, or depositors, all occurring on solifluction soils in the alpine belt of the high East African mountains. This adaptation to tropical high mountain solifluction has not been noted before.

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(Received 26th June, 1968)

BIRD RINGING REPORT 1967-1968

By

G. C. BACKHURST

INTRODUCTION

This report covers the period 1st July 1967 to 30th June 1968. The number of birds ringed is higher than ever before, unfortunately it is doubtful whether this upward trend can be maintained. One of the most prolific ringers, Dr. D. J. Pearson, left East Africa in June 1968 and his contribution will be missed greatly, although it is probable that some other experienced ringers will be coming out from England towards the end of 1968.

Ringing has continued to be centred around Kampala, Nakuru and Nairobi, with smaller amounts in Masindi, the Queen Elizabeth National Park, Kisumu and southern Tanzania. The number of ringers operating in the three countries is still very small indeed and, considering this, the amount of ringing done is highly satisfactory.

The full list of birds ringed is given in Table 1; birds which are palearctic migrants are printed in bold type, others which are included in the palearctic fauna but which are also ethiopian are not so distinguished. The order is that of Mackworth-Praed & Grant and their numbers are given before the English names, the nomenclature follows these authors for the African species, whereas Vaurie is used for the palearctic birds.

SOME NOTES ON RINGING IN EAST AFRICA

In the report on the previous season's activities (Backhurst 1968) I was able to mention only five ringers working in the whole of East Africa; this season the number rose to sixteen. Dr. D. J. Pearson, who left in June 1968, ringed over 2,000 birds, all but 97 of them being palearctic migrants. He ringed most of the waders, warblers, swallows and shrikes—the waders at Lake Nakuru, the others around Kampala. D. J. M. Caffyn ringed a few Yellow Wagtails at Thika, while W. P. Langridge ringed exactly 300 at Kisumu. A. R. E. Sinclair ringed all the Little Swifts as part of a research programme in the Serengeti. R. J. Wheater, Chief Game Warden in Murchison Falls National Park, ringed a few migrants and expects to ring many more next season. R. Douthewaite also ringed a few birds in Uganda as part of one of his research programmes. F. J. Thompson at Masindi, Uganda, ringed a number of birds including Redstarts—the first to be ringed in East Africa.

A. D. Forbes-Watson, working in Liberia, ringed six Yellow Wagtails with Nairobi rings and hopes to ring many more migrants in the autumn of 1968. D. A. Turner ringed a number of migrants in Kenya and Uganda and will continue to ring next season.

Mrs. A. L. Campbell, Dr. E. D. Steel, my wife and I worked mainly in the Nairobi area, either independently or together where 2,001 Yellow Wagtails were caught at Kabete, 1,093 at Eastleigh Sewage Works and 493 at Kariobangi Sewage Works. All but seven of the wagtails caught at Kabete were netted as they came in to roost in Napier Grass, *Pennisetum purpureum* Schumach. This year there were seldom suitable congregations of wagtails in the fields at Kabete to make the previous season's catching method practicable (Backhurst, *loc. cit.*), nevertheless, the roost provided over three times the previous season's total. Netting was successful on 59 nights with four catches over one hundred (maximum 122), the average catch was 33.8 Yellow Wagtails per night; in addition small numbers of other species, notably Olivaceous Warblers, were caught at the roost.

Very few sites have been found where large numbers of migrants can be caught. Passerines have only been worthwhile around Kampala, Kisumu and Nairobi.

Lake Nakuru has proved to be an excellent wader site, but so far the Coast, despite vast numbers of birds present, has proved unfruitful: J. R. Stjernstalt, working at Mtwara, southern Tanzania, lost all his nets and rings to a sudden tidal wave; the writer tried netting at Gazi, southern Kenya coast in October 1967, but only managed to ring six birds. It seems that, in contrast with the conditions in England, waders on the East African coast have a wide choice of high-water resting places so that, once disturbed by netting activities, they can easily move elsewhere.

ACKNOWLEDGEMENTS

Ringers gratefully acknowledge the co-operation of the City Engineer, Nairobi, for allowing them to operate at the two sewage works; the Director of the Kenya National Parks for permission to ring at Lake Nakuru; and of the Director of Veteri nary Services, Kenya, for permission to ring at Kabete.

Sincere thanks are also due to the following willing helpers, most of whom made ringing much easier at the sewage works and at Kabete: Miss P. Allen, Miss H. Anderson, L. C. and Mrs. R. L. Backhurst, W. Bruce, H. Buck, A. Bygrave, K. Campbell, Miss B. Debbenham, M. D. Ford, J. R. Hudson, Mrs. J. Hyland, A.n Igles, Miss H. Irwin, L. Joyner, E. Lonsdale, Miss U. McCurdy, J. McGhee, T. McNett, Miss C. Parsons, J. H. Phillips, R. Segal and F. Topliff. Very special thanks go to Mr. B. T. Parsons who contributed in many ways to make the season so successful. The assistance of my wife with all the ringing and with the administrative tasks was quite invaluable.

The Society is grateful to the Director of the National Museum, Nairobi, for allowing the Museum's address to appear on the rings.

TABLE 1

BIRDS RINGED BY THE EAST AFRICA NATURAL HISTORY SOCIETY RINGING ORGANIZATION

Palearctic Migrants

		1967/8	Grand total
4	Little Grebe *Podiceps ruficollis* (Pallas)	1	1
63	Sacred Ibis *Threskiornis aethiopicus* (Latham)	0	7
70	African Spoonbill *Platalea alba* Scopoli	0	73
72	Lesser Flamingo *Phoeniconaias minor* (Geoffroy)	0	6
77	African Pochard *Aythya erythrophthalma* (Wied)	0	3
83	Yellow-billed Duck *Anas undulata* Dubois	0	31
88	**Garganey** *A. querquedula* Linnaeus	0	1
89	Cape Wigeon *A. capensis* Gmelin	16	20
90	Hottentot Teal *A. punctata* Burchell	4	34
91	Red-billed Duck *A. erythrorhyncha* Gmelin	0	43
211	Quail *Coturnix coturnix africana* Temminck & Schlegel	0	1
242	Red-knobbed Coot *Fulica cristata* Gmelin	0	15
266	**Ringed Plover** *Charadrius hiaticula* Linnaeus	38	42
267	**Little Ringed Plover** *Ch. dubius* Scopoli	7	7
270	Chestnut-banded Sand Plover *Ch. venustus* Fischer & Reichenow	0	100
271	Kittlitz's Sand Plover *Ch. pecuarius* Temminck	92	106
272	Three-banded Plover *Ch. tricollaris* Vieillot	3	4
274	**Mongolian Sand Plover** *Ch. mongolus* Pallas	1	2
275	**Great Sand Plover** *Ch. leschenaultii* Lesson	2	4
286	Spurwing Plover *Hoplopterus spinosus* (Linnaeus)	4	5
287	Blacksmith Plover *H. armatus* (Burchell)	39	45
295	Avocet *Recurvirostra avosetta* Linnaeus	5	6
296	Black-winged Stilt *Himantopus himantopus* (Linnaeus)	2	7
298	**European Snipe** *Gallinago gallinago* (Linnaeus)	1	1
300	African Snipe *G. nigripennis* (Bonaparte)	2	3
303	**Curlew Sandpiper** *Calidris ferruginea* Pontoppidan	52	75
305	**Little Stint** *C. minuta* (Liesler)	554	793

306	**Temminck's Stint** *C. temminckii* (Liesler)	4	5
308	**Sanderling** *C. alba* (Pallas)	1	1
309	**Ruff** *Philomachus pugnax* (Linnaeus)	366	545
311	**Terek Sandpiper** *Xenus cinereus* Güldenstädt	3	3
312	**Common Sandpiper** *Tringa hypoleucos* Linnaeus	22	30
314	**Wood Sandpiper** *T. glareola* Linnaeus	32	44
317	**Marsh Sandpiper** *T. stagnatilis* (Bechstein)	128	185
318	**Greenshank** *T. nebularia* (Gunnerus)	3	4
329	Violet-tipped Courser *Rhinoptilus chalcopterus* (Temminck)	1	1
335	Crab Plover *Dromas ardeola* Paykull	2	2
349	**Gull-billed Tern** *Gelochelidon nilotica* (Gmelin)	3	3
361	**White-winged Black Tern** *Chlidonias leucoptera* (Temminck)	89	89
394	Tambourine Dove *Tympanistria tympanistria* (Temminck & Knip)	0	5
397	Emerald-spotted Wood-Dove *Turtur chalcospilos* (Wagler)	0	2
471	Pigmy Kingfisher *Ispidina picta* (Boddaert)	0	4
517	**Hoopoe** *Upupa epops epops* Linnaeus	1	1
560	Gabon Nightjar *Caprimulgus fossii* Hartlaub	1	1
586	Grey-throated Barbet *Gymnobucco bonapartei* Hartlaub	0	1
597	Golden-rumped Tinker Bird *Pogoniulus bilineatus* (Sundevall)	0	4
604	Yellow-billed Barbet *Trachylaemus purpuratus* (Verreaux)	0	2
616	Buff-spotted Woodpecker *Campethera nivosa* (Swainson)	0	1
630	Grey Woodpecker *Mesopicos goertae* (Müller)	2	2
643	Little Swift *Apus affinis* (Gray)	161	162
691	African Pied Wagtail *Motacilla aguimp* Dumont	3	9
694	**Grey Wagtail** *M. cinerea* Tunstall	0	1
—	**Yellow Wagtail** *M. flava* Linnaeus	4,034	7,721
708	**Tree Pipit** *Anthus trivialis* (Linnaeus)	11	80
713	**Red-throated Pipit** *A. cervinus* (Pallas)	3	14
735	Brown Illadopsis *Trichastoma fulvescens* (Cassin)	0	7
736	Pale-breasted Illadopsis *T. rufipennis* (Sharpe)	0	13
737	Scaly-breasted Illadopsis *T. albipectus* (Reichenow)	0	21
738	Mountain Illadopsis *T. pyrrhopterus* (Reichenow & Neumann)	0	1
740	Abyssinian Hill-Babbler *Pseudoalcippe abyssinicus* (Rüppell)	0	3
742	Dark-capped Bulbul *Pycnonotus tricolor* (Hartlaub)	39	40
743	White-vented Bulbul *P. barbatus* (Desfontaines)	0	1
746	Bristle-bill *Bleda syndactyla* Swainson	0	7
753	Brownbul *Phyllastrephus terrestris* Swainson	0	7
754	Northern Brownbul *Ph. strepitans* (Reichenow)	0	2
757	Smaller Yellow-streaked Greenbul *Ph. debilis* (Sclater)	0	3
758	Fischer's Greenbul *Ph. fischeri* (Reichenow)	0	33
760	Toro Olive Greenbul *Ph. hypochloris* (Jackson)	0	5
765	Olive-breasted Mountain Greenbul *Arizelocichla tephrolaema* (Gray)	0	15
768	Shelley's Greenbul *A. masukuensis* (Shelley)	0	4
769	Yellow-bellied Greenbul *Chlorocichla flaviventris* (Smith)	0	4
773	Zanzibar Sombre Greenbul *Andropadus importunus* (Vieillot)	0	3
774	Cameroon Sombre Greenbul *A. curvirostrus* Cassin	0	14
755	Little Greenbul *Eurillas virens* (Cassin)	2	22
776	Yellow-whiskered Greenbul *Stelgidocichla latirostris* (Strickland)	8	203
778	**Spotted Flycatcher** *Muscicapa striata* (Pallas)	1	3
785	Ashy Flycatcher *Alseonax cinereus* (Cassin)	0	2
796	White-eyed Slaty Flycatcher *Dioptrornis fischeri* Reichenow	0	4
805	Yellow Flycatcher *Chloropeta natalensis* Smith	1	1
815	Puff-back Flycatcher *Batis capensis* (Linnaeus)	0	2
822	Wattle-eye *Platysteira cyanea* (Müller)	1	1
823	Black-throated Wattle-eye *P. peltata* Sundevall	0	8
824	Chestnut Wattle-eye *Dyaphorophyia castanea* (Fraser)	0	10
825	Jameson's Wattle-eye *D. jamesoni* Sharpe	0	20
829	White-tailed Crested Flycatcher *Trochocercus albonotatus* Sharpe	0	3
831	Dusky Crested Flycatcher *T. nigromitratus* (Reichenow)	0	13
832	Paradise Flycatcher *Tchitrea viridis* (Müller)	0	1
833	Red-winged Paradise Flycatcher *T. suahelica* (Reichenow)	0	3
835	Black-headed Paradise Flycatcher *T. nigriceps* (Hartlaub)	0	1
840	African Thrush *Turdus pelios* Bonaparte	1	1
841	Olive Thrush *T. olivaceus* (Linnaeus)	0	15
845	Abyssinian Ground Thrush *Geokichla piaggiae* (Bouvier)	0	1
849	White-tailed Ant Thrush *Neocossyphus poensis* (Strickland)	0	1

850	**Rock Thrush** *Monticola saxatilis* (Linnaeus)	5	7
854	**Wheatear** *Oenanthe oenanthe* (Linnaeus)	7	10
855	**Isabeline Wheatear** *Oe. isabellina* (Temminck & Langier)	0	1
883	**Whinchat** *Saxicola rubetra* (Linnaeus)	23	36
884	White-browed Robin Chat *Cossypha heuglini* Hartlaub	0	6
887	Grey-winged Robin Chat *C. polioptera* Reichenow	0	1
889	Blue-shouldered Robin Chat *C. cyanocampter* (Bonaparte)	0	7
890	Red-capped Robin Chat *C. natalensis* Smith	0	37
892	Snowy-headed Robin Chat *C. niveicapilla* (Lafresnaye)	0	2
893	Robin Chat *C. caffra* (Linnaeus)	0	6
898	Equatorial Akalat *Sheppardia aequatorialis* (Jackson)	0	29
903	Brown-chested Alethe *Alethe poliocephala* (Bonaparte)	2	29
913	Eastern-bearded Scrub Robin *Erythropygia quadrivirgata* (Reichenow)	0	5
914	Brown-backed Scrub Robin *E. hartlaubi* Reichenow	1	1
915	White-starred Bush Robin *Pogonocichla stellata* (Vieillot)	0	12
917	**Redstart** *Phoenicurus phoenicurus* (Linnaeus)	5	5
921	**Nightingale** *Luscinia megarhynchos* Brehm	2	4
922	**Sprosser** *L. luscinia* (Linnaeus)	0	4
924	**Whitethroat** *Sylvia communis* Latham	3	9
925	**Garden Warbler** *S. borin* (Boddaert)	254	395
926	**Blackcap** *S. atricapilla* (Linnaeus)	8	26
933	**Barred Warbler** *S. nisoria* (Bechstein)	1	3
937	**Upcher's Warbler** *Hippolais languida* (Hemprich & Ehrenberg)	0	2
938	**Olivaceous Warbler** *H. pallida* (Hemprich & Ehrenberg)	7	14
942	**Great Reed Warbler** *Acrocephalus arundinaceus* (Linnaeus)	6	19
944	**Reed Warbler** *A. scirpaceus* (Hermann)	168	288
945	**Marsh Warbler** *A. palustris* (Bechstein)	6	8
946	African Reed Warbler *A. baeticatus* (Vieillot)	0	1
947	**Sedge Warbler** *A. schoenobaenus* (Linnaeus)	83	211
959	**Willow Warbler** *Phylloscopus trochilus* (Linnaeus)	90	187
964	Brown Woodland Warbler *Seicercus umbrovirens* (Rüppell)	0	4
977	Black-collared Apalis *Apalis pulchra* Sharpe	0	2
993	Grey-capped Warbler *Eminia lepida* Hartlaub	0	1
1010	Olive-green Camaroptera *Camaroptera chloronota* Reichenow	0	23
1011	Grey-backed Camaroptera *C. brevicaudata* (Cretzschmar)	1	3
1030	Hunter's Cisticola *Cisticola hunteri* Shelley	0	1
1045	Tawny-flanked Prinia *Prinia subflava* (Gmelin)	1	2
1049	Banded Prinia *P. bairdii* (Cassin)	0	7
1053	Black-faced Rufous Warbler *Bathmocercus rufus* (Reichenow)	1	23
1054	**Swallow** *Hirundo rustica* Linnaeus	218	781
1055	Uganda Swallow *H. angolensis* Bocage	0	4
1062	Red-rumped Swallow *H. daurica* Linnaeus	0	1
1068	**Sand Martin** *Riparia riparia* (Linnaeus)	26	754
1069	African Sand Martin *R. paludicola* (Vieillot)	0	2
1074	**House Martin** *Delichon urbica* (Linnaeus)	0	1
1089	Square-tailed Drongo *Dicrurus ludwigii* (Smith)	0	1
1103	**Lesser Grey Shrike** *Lanius minor* Gmelin	2	2
1112	**Red-backed Shrike** *L. collurio* Linnaeus	50	76
1125	Tropical Boubou *Laniarius aethiopicus* (Gmelin)	0	7
1128	Black-backed Puff-back Shrike *Dryoscopus cubla* (Shaw)	1	1
1164	**Golden Oriole** *Oriolus oriolus* (Linnaeus)	0	1
1184	Violet-backed Starling *Cinnyricinclus leucogaster* (Boddaert)	0	3
1190	Lesser Blue-eared Glossy Starling *Lamprocolius cholropterus* (Swainson)	2	2
1219	Yellow White-eye *Zosterops senegalensis* Bonaparte	6	6
1221	Green White-eye *Z. virens* Sundevall	0	2
1223	Kikuyu White-eye *Z. kikuyuensis* Sharpe	0	2
1230	Bronze Sunbird *Nectarinia kilimensis* Shelley	0	1
1238	Copper Sunbird *Cinnyris cupreus* (Shaw)	1	1
1245	Mariqua Sunbird *C. mariquensis* Smith	2	2
1254	Eastern Double-collared Sunbird *C. mediocris* Shelley	2	2
1263	Scarlet-chested Sunbird *Chalcomitra senegalensis* (Linnaeus)	2	2
1266	Green-headed Sunbird *Cyanomitra verticalis* (Latham)	1	1
1269	Olive Sunbird *C. olivacea* (Smith)	0	26
1271	Collared Sunbird *Anthreptes collaris* (Vieillot)	0	3
1281	Green Hylia *Hylia prasina* (Cassin)	1	5
1300	Grey-headed Sparrow *Passer griseus* (Vieillot)	2	2

1325	Yellow-backed Weaver *Ploceus capitalis* (Latham)	30	30
1335	Dark-backed Weaver *Symplectes bicolor* (Vieillot)	0	1
1337	Spectacled Weaver *Hyphanturgus ocularis* (A. Smith)	2	2
1342	Holub's Golden Weaver *Xanthophilus xanthops* (Hartlaub)	2	2
1346	Black-billed Weaver *Heterhyphantes melanogaster* (Shelley)	0	4
1347	Emin's Weaver *Othyphantes emini* (Hartlaub)	22	22
1348	Reichenow's Weaver *O. reichenowi* (Fischer)	0	8
1360	Red-billed Quelea *Quelea quelea* (Linnaeus)	1	1
1361	Red-headed Quelea *Q. erythrops* (Hartlaub)	6	6
1375	Red-collared Widowbird *Coliuspasser ardens* (Boddaert)	1	1
1380	Black and White Mannikin *Spermestes poensis* (Fraser)	1	1
1386	Grey-headed Negro-Finch *Nigrita canicapilla* (Strickland)	0	2
1389	Brown Twinspot *Clytospiza monteiri* (Hartlaub)	3	3
1391	Red-headed Blue-bill *Spermophaga ruficapilla* (Shelley)	0	14
1399	Abyssinian Crimson-wing *Cryptospiza salvadorii* Reichenow	0	2
1406	Peter's Twinspot *Hypargos niveoguttatus* (Peters)	0	1
1410	Green-winged Pytilia *Pytilia melba* (Linnaeus)	3	3
1411	African Firefinch *Lagonosticta rubricata* (Lichtenstein)	1	1
1413	Red-billed Firefinch *L. senegala* (Linnaeus)	6	6
1422	Fawn-breasted Waxbill *Estrilda paludicola* Heuglin	6	6
1425	Black-crowned Waxbill *E. nonnula* Hartlaub	2	2
1431	Red-cheeked Cordon-bleu *Uraeginthus bengalus* (Linnaeus)	1	1
1433	Purple Grenadier *Granatina ianthinogaster* (Reichenow)	0	1
1441	Pin-tailed Whydah *Vidua macroura* (Pallas)	10	10
1448	Yellow-fronted Canary *Serinus mozambicus* (Müller)	3	3
1461	Streaky Seed-eater *S. striolatus* (Rüppell)	0	1
1462	Thick-billed Seed-eater *S. burtoni* (Gray)	0	1
	TOTAL	6,836	14,112
	TOTAL PALEARCTIC MIGRANTS	6,320	12,498
	TOTAL NUMBER OF SPECIES	95	186
	TOTAL PALEARCTIC SPECIES	41	48

TABLE 2

RECOVERIES AND CONTROLS OF BIRDS RINGED IN EAST AFRICA

Key to symbols and terms

Ring number: where this is in italics the ring has been returned.

Age	: f.g.	— full grown, age uncertain.
	ad.	— adult, at least one year old.
	pull.	— young, not yet able to fly.
	juv.	— juvenile.
	1st W.	— 1st winter.
Sex	: ♂	— male.
	: ♀	— female.
Manner of recovery:	+	— shot or killed by man.
	×	— found dead or dying.
	/?/	— manner of recovery unknown.
	v	— caught or trapped and released with ring.
	( )	— caught or trapped alive and not released, or released but with ring removed.

A recovery in the strict sense is a ringed bird found dead, whether by the ringer himself or reported by a member of the public; a control is a bird ringed by one ringer and retrapped by another, or a bird retrapped by the original ringer at a point more than three miles from the locality where it was first ringed.

Red Knobbed Coot *Fulica cristata*

D.0587	?	6.4.65	Ngorongoro Crater, Tanzania. 3°12′S., 35°30′E. JG
	+	16.12.67	Lessos Dam, Kenya. 0°12′N., 36°16′E.

Little Ringed Plover *Charadrius dubius*

A.3194	1st W.	14.12.67	Lake Nakuru, Kenya. 0°20′S., 36° 06′E. DJP
	×	26.5.68	*near* Sukhumi, Georgian SSR, **U.S.S.R.** 43°00′N., 41°01′E.

Ruff *Philomachus pugnax*

C.0466	f.g.♂	25.3.68	Lake Nakuru, Kenya. DJP
	+	17.5.68	Tyumen Region, 200 km. NE of Surgut, **U.S.S.R.** 62°50′N., 73°00′E.
B.0900	f.g.♀	6.4.68	Lake Nakuru, Kenya. GCB
	+	31.5.68	Krasnoyarst Region, *near* Pirovskoe, **U.S.S.R.** 57°38′N., 92°15°′E

Yellow Wagtail *Motacilla flava*

J. 4065	f.g.	1.12.66	Kabete, Kenya. 1°16′S., 36°43′E. GCB.
	× (cat)	25.7.67	Oktyabr'sky District, Tatarskaya A.S.S.R., **U.S.S.R.** 54°24′N., 50°47′E.
J. 14759	f.g.	10.2.68	Kabete (at roost). EDS
	/?/	24.4.68	*near* Astrakhan, Kalmytskaya A.S.S.R., **U.S.S.R.** 46°24′N., 48°02′E.
J. 4409	f.g.	20.12.66	Kabete. GCB
	v.	21.10.67	Eastleigh. 1°16′S., 36°51′E 10 miles ESE.
J. 4440	Ad.♂	7.1.67	Eastleigh. GCB (*M.f. lutea*).
	v.	10.12.67	Kariobangi. 1°15′S., 36°53′E. 3 miles ENE.
J. 5026	f.g.	14.1.67	Eastleigh. GCB
	v.	12.11.67	Kariobangi. 3 miles ENE.
J. 8085	f.g.	30.3.67	Eastleigh. JBS
	v.	17.12.67	Kariobangi. 3 miles ENE.
J. 8390	Ad.♂	8.10.67	Eastleigh. GCB (*M.f. flava*).
	v.	12.1.68	Kabete. 10½ miles WNW.
J. 8705	f.g.	5.11.67	Eastleigh. GCB
	v.	12.11.67	Kariobangi. 3 miles ENE.
J. 8759	f.g.	12.11.67	Kariobangi. GCB
	v.	25.11.67	Eastleigh. 3 miles WSW.
J. 8994	f.g.	1.12.67	Kariobangi. GCB
	v.	27.1.68	Kabete. 12½ miles W.
J. 12503	f.g.	27.12.67	Dandora Swamp. 1°16′S., 37°00′E. DAT
	v.	14.1.68	Kabete. c.15½ miles W.
J. 12450	Ad.♂	29.12.67	Kabete. GCB (*M. f. flava*).
	v.	23.3.68	Eastleigh. 8 miles ESE.
J. 11801	f. g.	6.1.68	Eastleigh. LC
	v.	21.1.68	Kariobangi. 3 miles ENE.
J. 4466	Ad.♂	7.1.68	Eastleigh. GCB (*M. f. flava*)
	v.	10.12.67	Kariobangi. 3 miles ENE.

In addition the ringing details of the following bird, recovered in the year 1966–67, have been received:

Red Knobbed Coot *Fulica cristata*

D.0503	?	6.4.65	Ngorongoro Crater, Tanzania. JG
	+	16.1.67	East side of Lake Naivasha, Kenya. 0°45′S., 36°23′E.

RETRAPS

A retrap is a ringed bird captured and released by the original ringer, or his associates, at or near (within three miles) the locality where it was originally ringed (Spencer, 1965).

An encouraging number of birds have been retrapped from previous seasons; in the last report (Backhurst, 1968) there were only seven such retraps, this year there were 116 including four which are listed in Table 2 as controls. The explanation of this high number is twofold: the number of birds ringed in the 1966/67 season was higher than ever before, i.e. there were far more birds available for retrapping in 1967/68; it is also clear that many birds are faithful to the same winter quarters or that they pass through the same area (where they are ringed and retrapped) on their way to more distant winter quarters.

Table 3

BIRDS RETRAPPED FROM PREVIOUS SEASONS

Little Stint *Calidris minuta*	5
Ruff *Philomachus pugnax*	3
Marsh Sandpiper *Tringa stagnatilis*	1
Yellow Wagtail *Motacilla flava*	75
Whinchat *Saxicola rubetra*	1
Garden Warbler *Sylvia borin*	5
Great Reed Warbler *Acrocephalus arundinaceus*	3
Reed Warbler *A. scirpaceus*	14
Sedge Warbler *A. schoenobaenus*	9

Apart from the following exceptions all the above were ringed in the 1966/67 season:

Yellow Wagtail *Motacilla flava*

A. 0279	f.g.	15.161	Eastleigh. EJB
	v.	7.10.67	ditto.

Garden Warbler *Sylvia borin*

J. 1426	f.g.	31.3.66	Gala, Uganda. 1°18′N., 31°49′E. DJ
	v.	18.12.66	ditto.
	v.	6.4.67	ditto.
	v.	12.11.67	ditto.

Reed Warbler *Acrocephalus scirpaceus*

J. 1406	f.g.	18.3.66	Gala. DJP
	v.	31.3.66	ditto.
	v.	19.1.68	ditto.
J. 1414	f.g.	23.3.66	Gala. DJP
	v.	13.2.68	ditto.

Sedge Wabler *A. schoenobaenus*

J. 1401	f.g.	18.3.66	Gala. DJP
	v.	25.2.67	ditto.
	v.	28.12.67	ditto.

KEY TO RINGERS' INITIALS IN LIST OF RECOVERIES

GCB	G. C. Backhurst	DJP	D. J. Pearson
EJB	Miss E. J. Blencowe	JBS	J. B. Smart
LC	Mrs. L. Campbell	EDS	E. D. Steel
JG	J. Goddard	DAT	D. A. Turner

OTHER RINGERS IN EAST AFRICA

D. Caffyn
R. Douthwaite
D. P. Ebbutt
A. D. Forbes-Watson
M. D. Ford
W. P. Langridge
J. M. Locke
A. Sinclair
R. Stjernstedt
F. J. Thompson

R. J. Wheater

Table 4

RECOVERIES IN EAST AFRICA OF BIRDS RINGED ABROAD

This list contains some birds which were recovered before 1st July 1967; it is hoped eventually to bring Eggeling's (1951) list up to date by publishing foreign-ringed recoveries in these annual reports.

The signs and symbols are the same as those used in Table 2.

Cattle Egret *Bubulcus ibis*

Pretoria			
635/10887	pul.	—.12.62	Gumtree Dist., *near* Ficksburg, O.F.S., **S. Africa**, 28°51′S. 27°43′E.
	( )	20.6.67	Pakwach, Uganda. 2°28′N., 31°30′E.
Pretoria			
553/3272	juv.	13.12.57	Faithful Fountains, **S. Africa.** 33°40′S., 26°30′E.
	+	31.3.60	Tunduru, Tanganyika. 11°20′S., 37°20′E.
Pretoria			
C. 8698	juv.	17.2.57	Westdene Pan Benoni, **S. Africa.** 26°12′S., 28°18′E.
	+	25.8.58	Ngudu, Kwimba, Tanganyika. 2°40′S., 33°30′E.

White Stork *Ciconia ciconia*

Pretoria			
C. 1010	juv.	3.12.61	Bredasdorp, **S. Africa.** 34°35′S., 20°00′E.
	+	25.3.62	Tunduma, Tanganyika. 9°00′S, 33°00′E.
Hiddensee			
200 785	juv.	7.7.64	Bleyen, Seelow, Frankfurt/Oder, **East Germany.** 52°35′N., 14°37′E.
	+	25.3.65	Aboki, *near* Lira, Lango Dist., Uganda. 2°22′N., 32°42′E.
Hiddensee			
3 569	juv.	13.7.66	Fienerode, Genthin, Magdeburg, **East Germany.** 52°21′N., 12°10′E.
	+	19.1.67	West Kilimanjaro, Tanganyika. *c.*3°S., 37°20′E.
Hiddensee			
3 559	juv.	10.7.66	Zitz, Brandenburg, Potsdam, **East Germany.** 52°20′N., 12°20′E.
	+	0.5.67	Acholi District, Uganda. *c.*3°N., 32°30′E.
Hiddensee			
3 571	juv.	13.7.67	Fienerode, Genthin, Magdeburg, **East Germany.** 52°21′N., 12°10′E.
	×	27.6.67	Kitale, Kenya. 1°N., 35°E.
Hiddensee			
202 251	juv.	24.6.67	Bendelin, Perleberg, Schwerin, **East Germany.** 52°55′N., 12°10′E.
	+	17.2.68	Ligera, Tanganyika. 10°59′S., 36°23′E.
Hiddensee			
200 329	pull.	24.6.64	*near* Genthin, **East Germany.** 52°30′N., 12°12′E.
	× (predators)	13.3.65	Timau, Kenya. 0°05′N., 37°14′E.
Varsovia			
B530.678	pull.	21.6.56	Zbietka, *near* Wagrowiec, **Poland.** 52°44′N., 17°18′E.
	×	16.1.63	Sotik, Kenya. 0°40′S., 35°08′E.
Moskva			
A. 67.216	pull.	28.6.61	*near* Chernigov, **U.S.S.R.** 51°33′N., 31°20′E.
	×	9.2.63	Yatta Plateau, north of Ithanga Hills, Kenya. *c.*1°25′S., 37°30′E.
Moskva			
B. 67.306	pull.	25.6.59	Beloviesha Reserve, **U.S.S.R.** 52°40′N., 24°00′E.
	/?/	15.3.60	Seronera, Serengeti, Tanganyika. 2°16′S., 34°47′E.

Shoveler *Anas clypeata*

Moskva			
E. 581.839	f.g.	14.8.61	Asrakhan Reserve, **U.S.S.R.** 46°25′N., 49°05′E.
	+	10.3.63	Lake Naivasha, Kenya. 0°45′S, 36°25′E.

African Pochard *Aythya erythrophthalma*

Pretoria			
C. 5020	ad.	6.12.53	Modder East Dam, Transvaal, **S. Africa.** *c.*25°20′S., 30°E.
	/?/	–.11.54	Lake Naivasha, Kenya. 0°45′S., 36°20′E.

Lesser Spotted Eagle *Aquila pomarina*

Tartu			
15270	pull.	—.7.54	Aegviidu District, Estonian S.S.R., **U.S.S.R.** *c.*59°16′N., 25°36′E.
	+	—.3.55	Geita District, Tanganyika. *c.*2°35′S., 32°56′E.

Little Stint *Calidris minuta*

Pretoria			
601/44213	?	1.12.66	Blue Lagoon, Kafue Flats, **Zambia.** 15°27′S., 27°24′E.
	v.	25.3.68	Lake Nakuru, Kenya. (Original ring removed, replaced by *Nairobi* A. 3376).
	v.	6.4.68	Lake Nakuru.

Swallow *Hirundo rustica*

London			
HH. 55.749	juv.	12.9.66	Bedworth, Nuneaton, **England**. (At roost) 52°29′N., 1°28′W.
	( )	5.12.66	Anaka Paromo, *near* Gulu, Uganda. 2°41′N., 32°27′E.
Pretoria			
601/24345	f.g.	8.4.67	Vischgewaard, **S. Africa.** *c*.26°10′S., 28°E.
	×	15.5.67	Tororo, Uganda. 0°42′N., 34°11′E.
Pretoria			
601/01716	f.g.	27.2.66	Rosherville Dam, **S. Africa.** *c*.26°S., 28°E.
	( )	15.10.67	Busia, Kenya. 0°25′N., 34°15′E.
Pretoria			
601/07278	f.g.	20.3.66	Rosherville Dam, **S. Africa.**
	( )	18.10.67	Tororo, Uganda.
Pretoria			
662/02868	f.g.	2.2.67	Escom Dam, Kimberley, **S. Africa.** 28°45′S., 24°46′E.
	v.	14.10.67	Busia, Kenya.
	v.	23.10.67	Tororo, Uganda.
Pretoria			
601/47863	f.g.	6.2.66	Rosherville Dam, **S. Africa.**
	( )	27.10.67	Amukura, Kenya. 0°36′N., 34°16′E.

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(*Received 15th August 1968*).

A NOTE ON THE POSSIBLE REPRODUCTIVE STRUCTURES IN KENYAN *UDOTEA ORIENTALIS* A. & E. S. GEPP, (CHLOROPHYTA).

by

SHAKUNTALA A. MOORJANI,
University College, Nairobi

INTRODUCTION

The genus *Udotea* is pan-tropical with extra-tropical (Natal Coast) extensions. *Udotea orientalis* A. & E. S. Gepp is an Indo-Pacific species. It has been reported from Kenya (Gerloff, 1960; Isaac, 1967), Mosambique and Natal coast of South Africa (Isaac, 1956). The Siboga Expedition records include Zanizbar in the Indian Ocean list; in the Pacific Ocean it has been reported from Queensland (Australia), China Sea and Japan (A. & E. S. Gepp, 1911).

U. orientalis is widespread along the Kenya coast but it is generally less common than *U. indica* A. & E. S. Gepp. A third species *U. flabellum* (Ell. & Soland) Howe has been recorded for the Kenya coast (Isaac, 1967), but so far has only been found in the Lamu region (personal communication). *U. orientalis* is primarily an alga of quiet or protected waters such as those to seaward of mangroves and in lagoons. It is sometimes found in more exposed situations but not so much as *U. indica.*

The morphology of *Udotea* is well known and has been fully described by Gepp (1911). There is, however, no certain information and few published records of the reproductive structures, and hence it is worthwhile recording the observations made on the Kenya material of *U. orientalis.*

THALLUS STRUCTURE

(a) **External morphology**

The thallus of *U. orientalis* consists of a well differentiated stipe and frond (fig. 1a). The stipe arises from a bulbous rhizoidal mass and may be up to 2.5 cm. long and up to 3 mm. thick. The frond is well developed, broad and cordate in shape. It varies in size according to the habitat. Generally, those growing in quiet waters are larger than those growing in disturbed waters. The frond may be up to 6.5 cm. broad and 4 cm. long. It is concentrically zoned and longitudinally striate due to moderate calcification. The margin of the frond may be entire or lacerate.

(b) **Internal structures**

The frond is built up of smooth-walled coenocytic filaments which radiate from the stipe to the margin of the frond. The filaments are repeatedly dichotomously branched and show constrictions at markedly unequal distances above the points of dichotomy (fig. 1b). This is a characteristic feature of this species. The filaments vary from 24μ to 35μ in diameter and are packed with starch granules and chloroplasts.

POSSIBLE REPRODUCTIVE STRUCTURES

Phillips reported a small ovoid body at the apex of one filament of Atlantic species *U. cyathiformis* Decaisne, and suggested a similarity between it and the female gametangium of *Codium* (Phillips, 1957). Phillips observed a wall at the base of the organ. The wall was thinnest in the middle, where he also observed cytoplasmic strands between the filament and the organ. He concluded that the wall was newly formed. He ruled out the possibility that this organ might be a normal growth phenomenon, with the other new filament of the dichotomy broken off, because the point

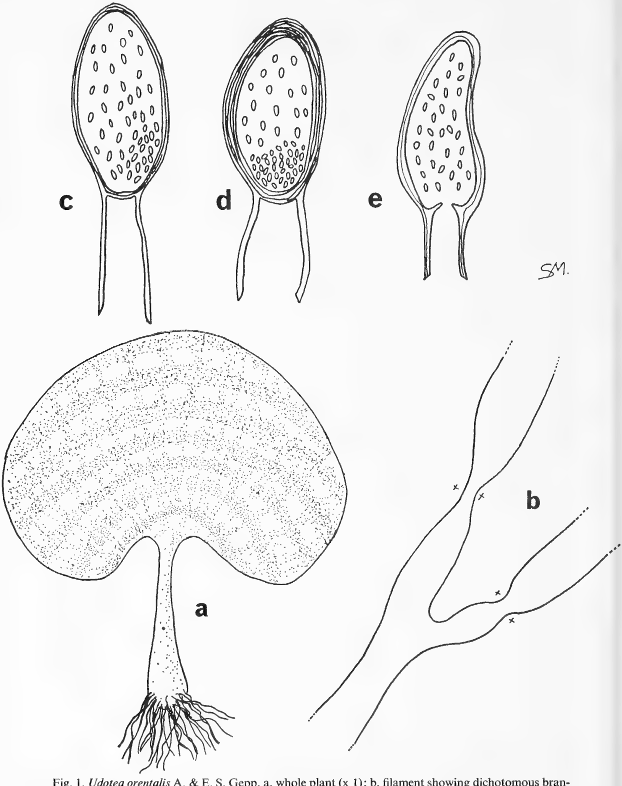

Fig. 1. *Udotea orentalis* A. & E. S. Gepp, a, whole plant (x 1); b, filament showing dichotomous branching (x 200); c, ovoid body at apex of filament (x 200); d, ovoid body showing thicker wall (x 200); e, filament with ovoid body, showing slight ingrowths of filament walls (x 200).

of constriction was above the dichotomy and no branching or trace of branching was evident. The organ was dark green and so he concluded that it was not a vegetative growth but a female gametangium.

POSSIBLE REPRODUCTIVE STRUCTURES IN KENYA *U. ORIENTALIS*

In October, 1967, during an algology practical class at the University College Nairobi, when the author was examining teased filaments of *U. orientalis*, she came across an ovoid body at the apex of one filament (fig. 1c).

On careful examination and comparison with Phillips' drawing of a similar structure in *U. cyathiformis*, very close similarities were observed except that the cytoplasmic strands mentioned by Phillips were not observed.

An extensive search for similar structures was carried out on herbarium and preserved material. While examining filaments of preserved material of *U. orientalis*, Isaac B. 27 and 3221 from Mokowe mud flats Lamu, Kenya, in front of mangroves, the author came across another ovoid body at the apex of a filament (fig. 1d).

The ovoid body measured 105μ in length and the greatest width was 30μ. The width of the filament bearing the body was 24μ. Examination of the body under oil immersion revealed that the basal wall of the organ was complete and also that the wall surrounding the body was thicker than the filament wall. The thickness of the wall surrounding the ovoid body was 4.5μ compared to 3μ of the filament wall. The basal wall of the body was of the same thickness as that surrounding the body itself. Thus the organ was completely isolated from the filament and hence the body is very likely a mature gametangium. It was also observed that the basal half of the gametangium was packed densely with roundish bodies.

Phillips suggests in his paper on *U. cyathiformis* that it is probable that the basal wall of the organ arises by ingrowth of filament walls at the organ base. During the course of extensive examinations for similar ovoid shaped bodies at the apex of filaments, a body was observed with slight ingrowths of the filament walls as shown in fig.1e. These ingrowths were visible under a phase contrast microscope. This observation is in agreement with Phillips' suggestion of the origin of the basal wall of the organ.

ACKNOWLEDGEMENTS

I am grateful to Prof. Wm. Edywn Isaac of the Botany Department, University College Nairobi, for his encouragement and assistance in the preparation of this note.

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(*Received 26th June, 1968*)

A NINETEENTH CENTURY REFERENCE TO THE USE OF TOOLS BY THE EGYPTIAN VULTURE

by

R. H. BAXTER, S. K. URBAN AND L. H. BROWN

A recent note by the van Lawick-Goodalls (1966) has described, and illustrated with remarkable photographs, the manner in which the Egyptian Vulture, *Neophron perconopterus* (Linnaeus), breaks Ostrich eggs by lifting stones in its beak and throwing them at the eggs. In this connection the following account (Wood, 1877), published more than ninety years ago, is perhaps of interest:

> "Two articles of diet which certainly do not seem to fall within the ordinary range of vulture's food are said to be consumed by this bird. The first is the egg of the ostrich, the shell of which is too hard to be broken by the feeble beak of the Egyptian Vulture. The bird cannot, like the lämmergeier, carry the egg into the air and drop it on the ground, because its feet are not large enough to grasp it, and only slip off its round and polished surface. Therefore, instead of raising the egg into the air and dropping it upon a stone, it carries a stone into the air and drops it upon the egg. So at least say the natives of the country which it inhabits, and there is no reason why we should doubt the truth of the statement.
>
> The other article of food is a sort of melon . . ."

It seems likely that the author had heard or read a first or second hand account of the behaviour described by the van Lawick-Goodalls but that, remembering the behaviour of the Lämmergeyer, he had assumed that the stone was lifted in the claws rather than in the beak. That he did interpret his information in this way is clearly shown by a later passage (p. 525) in which he says:

> "The scattered eggs (of the Ostrich) . . are often eaten not only by beasts, but by birds of prey; the former breaking the shells by knocking them against each other, and the latter by picking up larges stone in their claws, rising above the eggs, and dropping the stones on them".

However, it is interesting that there have been a few reports based on information provided by aborigines, and one on actual observation by a European, that the Australian Black-breasted Buzzard Hawk, *Hamirostra melanosternon*, breaks Emu eggs in precisely this manner (Chisholm, 1954); perhaps further observations on the Egyptian Vulture may show that it, too, sometimes breaks eggs in this way.

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(*Received 3rd June, 1968*)

THE AFRICAN PITTA

Pitta angolensis, Vieillot

by

V. E. M. BURKE

This brilliantly coloured bird is rarely seen. Most of the records are made as the result of it flying into a light at night while on local migrations.

As the records are few, the following observation and summary of what Moreau, Praed & Grant have to say may be of interest.

An African Pitta was brought to me by the night watchman of the Mwese Hospital, Tanzania at about 8 o'clock in the evening of the 20th November, 1967. The bird had flown against the window of a lighted room. There was a spot of blood at the base of its beak but it was otherwise unhurt. I kept it in a basket overnight and next morning, placed it on open ground and pointed it due north, believing at the time that this was the way it ought to have been going. The bird paused for a moment as if taking its bearings, leaped into the air, swung round and flew off due south with a a low, direct and fast flight.

Mwese lies 6°S of the Equator, about 30 miles east of Lake Tanganyika and mid-way between Kungwe (or Kungu) Mountain and the township of Mpanda. Mwese is a hill about 200 square miles in area which rises to 6,000 ft. like an island surrounded by *Brachystegia*, *Miombo* bush. The area is burnt annually and the dominant trees are *Combretum* and *Protea* with narrow strips of forest along the rivers. The rainfall probably averages about 40 inches per annum and normally starts in November and ends in March.

In 1967 there had been considerable rain by the 20th November when the bird was found.

Praed & Grant, in *The African Handbook of Birds, Series I.* describe the general distribution of the African Pitta as Central Tanzania to the Transvaal and, in the non-breeding season, to the eastern Congo, Uganda and Kenya. They go on to say that the bird seems to breed from the Transvaal up to central Tanzania from September to March and to migrate in the non-breeding season to northern Tanzania, Uganda and southern Kenya.

One must suppose from this background that the Pitta seen in central Tanzania flying south on the 21st November, 1967 was returning, a little late, to its breeding area from its sojourn in the north.

Moreau, in *The Bird Faunas of Africa and its Islands* uses the Pitta as an example of migration within Africa. He indicates that its breeding range is from Southern Tanzania to Malawi and Rhodesia and that its favourite breeding habitat is dense semi-deciduous thicket at low altitudes.

Most of the records he quotes are of birds flying into lighted windows at night and he describes the occasion, when he captured a Pitta in such circumstances, as "One of the thrills of my ornithological life. . . to put my hands on this gorgeously coloured bird, unhurt as it was".

The records he quotes are all of Pitta found between Abercorn in Zambia and the forests of Uganda, that is from 8°S to about 2°N and as there are no breeding records in this area, it is assumed that these are the limits of the migratory range.

The most western of the records are from Lake Kivu in eastern Congo Republic and the most eastern are from the Tanzania coastal belt.

On the assumption that the migration are on a north-south axis, I have divided these records longitudinally, by the line of latitude of 35°E, i.e. Uganda, Western

Tanzania and Zambia to the west of the line, and Kenya and eastern Tanzania to the east.

To the west of the line, the records, including my own, follow the Western Rift Valley. Abercorn, 8°S, at the south end of Lake Tanganyika, has six records, all in the month of December. My own record from Mwese, 6°S, is for the month of November. There are two dates mentioned for Lake Kivu, 2°S, in April and May. At the northern end of the range in the Uganda forests, say 2°N, Moreau quotes records in May, June and July.

I interpret these records as indicating that breeding is south of 8°S and from December to March, which coincides with the rains in Zambia, Malawi and southern Tanzania; that the birds move north up the line of the Western Rift Valley in April and May and spend June to October in Uganda and return down the same route in November and December.

The records in the eastern half of the area are from four places. The birds are recorded as breeding in the extreme south of Tanzania, 10°S; there is a single record of a bird from the Itigi thicket, 8°S, mid-way between Tabora and Dodoma, in the month of December, but it is not revealed whether the bird was breeding or on migration; there are then 10 records all for May and June from north-eastern Tanzania, 5°S, including 5 of Moreau's own records from Amani; finally there are two records from Nairobi, 1°S, for May and June.

My guess is that the Itigi bird, in December was either going south to breed or actually breeding at Itigi, and that the North-Eastern Tanzania birds and the Nairobi birds were all going south, but where they were going I do not know as there are no records from the Kenya highland forests or from the coast.

It is possible that this beautiful bird is bestowing its delightful compliment of flying through bed-room windows more frequently than is generally known. More records of its movements would be very interesting.

(*Received 3rd June, 1968.*)

NATURE NOTE

Notes on the life history of *Aiteta veluta* Hamps (Lep., Nocutuidae)

The larva of this species is a dark brown to black over almost the entire surface, with a black head. Segments 2–4 are enlarged to form a rounded lump just behind the head. This lump has a greenish colour over the most expanded part grading to black round the base of the lump. There is a small triangular hump on the last segment above the claspers, rather like that in some of the *Notodontidae*. Following the shape of this hump, on each side of it, there is a short white line. The larva is about 1½ inches long when full grown. The foodplant is *Markhamia hildebrandtii* (Baker) Sprague.

The chrysalis is formed in a cocoon of dirty yellowish-white silk which is more or less the shape of the pupa of *Papilio machaon* L. of Europe. It is about 1 inch in length with a prominent pointed bump over the thorax of the chrysalis. The larva started to spin up on 14th March 1969 and emerged on 28th March 1969.

1st April, 1969.

M. P. Clifton,
Entomologist.

BOOK REVIEWS

BACKGROUND TO EVOLUTION IN AFRICA

Edited by Walter W. Bishop and J. Desmond Clark, published by the University of Chicago Press, 1967, pp. x+935. U.K. price 247/-

This large book is the proceedings of a symposium: "Systematic Investigation of the African later Tertiary and Quarternary" held at Burg Wartenstein Castle, Austria in July and August 1965 and financed by the Wenner-Gren Foundation for Anthropological Research, New York. The implicit claim of the title to cover all evolution is of course misleading; instead the book's declared object is to review Quarternary and later Tertiary research in Africa over the past decade, and to initiate the revision of existing geological and archaeological sequences, terminologies and methods. One subject which is not dealt with is the evolution of man himself, but all else which forms the relevant background to this topic is covered. The book is divided into three parts: 184 pages of palaeontology, 220 of stratigraphy, and 464 of archaeology, followed by a list of recommendations in English and French and a post-conference appraisal. Eight of the forty-three papers are in French with English summaries, the remainder are in English. Each paper is followed by a discussion in English. The philosophy of the book is stated by R. F. Flint on p. 189: that "following a code forces closer examination and more accurate description of the stratigraphy at any place, and of changes from place to place. Hence it improves correlation and further illuminates the inferred historical events". The precept applies as much to palaeontology and archaeology as to stratigraphy. Advances in knowledge and understanding can come from such codification as well as from entirely new discoveries, and in fact new discoveries presented in isolation can sometimes increase confusion.

Some of the authors were asked to draw up formal provisional charts for the stratigraphy of the more important site areas. These charts separate clearly the climatic, chronological and faunal aspects of stratigraphic nomenclature from the more basic rock units themselves, and will be one of the factors ensuring the book a longer period of usefulness than might be expected for the proceedings of a symposium. Archaeology in particular suffers from the confusion of cultural-stratigraphic with time-stratigraphic terms, and the archaeologists brought a selection of material to the conference, so as better to reach agreement on a unified nomenclature of forms and types of stone tools and on a terminology of the techniques used in their manufacture. Their conclusions have been included in the recommendations, which should

have a beneficial effect if followed by future authors, especially as the archaeologists deliberately stopped short of trying to impose one overall system on their subject. One may hope that the necessary money and enthusiasm will be forthcoming for future work. Mammalian palaeontology is not sufficiently advanced for the construction of faunal zones with their attendant problems of nomenclature and pan-African correlations, but one paper draws up a sequence for the Lake Chad area based on elephants alone, and two papers consider the problems in southern Africa.

The printing of the main points arising in discussion of each paper is an excellent feature of the book, helping to show the untidy miasma of one-sided conceptions through which factual data are interpreted, which opposes as well as fosters the processes of codification, and which contrasts with the disciplined presentation of good scientific papers. Such discussions are often unavoidably disjointed, but contain many interesting and even amusing scraps of information.

This is not a book for the general reader, but for anyone who wishes to be more than a general reader in the subject it is as good and up-to-date a starting point as any available. The post-conference appraisal would be a good place for such a reader to make his approach.

A. W. G.

FLORA OF TROPICAL EAST AFRICA

A further series of this Flora has now been received from the publishers, The Crown Agents for Overseas Governments and Administrations. Unless otherwise stated these were published on the 28th June 1968, U.K. prices are quoted. The families are:—

Aquifoliaceae by B. Verdcourt, 4 pp.+1 fig. 1/-
Brexiaceae by B. Verdcourt, 3 pp.+1 fig. 1/-
Caprifoliaceae by B. Verdcourt, 3 pp.+1 fig. 1/-
Cucurbitaceae by C. Jeffrey, 156 pp.+26 figs. published on the 28th June 1967. 18/-
Dilleniaceae by G. Ll. Lucas, 6 pp.+1 fig. 1/6
Dipsaceae by D. M. Napper, 11 pp.+4 figs 1/6
Elatinaceae by B. Verdcourt, 5 pp.+1 fig. 1/-
Icacinaceae by G. Ll. Lucas, 17pp.+6 figs. 2/6
Monimiaceae by B. Verdcourt, 33 pp.+1 fig. 1/-
Orchidaceae, Part 1 by V. S. Summerhayes, 235 pp.+41 figs. published on the 29th July, 1968 . . . . 28/-
Pontederiaceae by B. Verdcourt, 8 pp.+3 figs. 1/6
Sapotaceae by J. H. Hemsley, 78 pp.+13 figs. 8/6
Scytopetalaceae by B. Verdcourt, 3 pp.+1 fig. 1/-
Sphenocleaceae by H. K. Airy Shaw, 3 pp.+1 fig. 1/-
Valerianaceae J. O. Kokwaro, 9 pp.+2 figs. 1/6

The Cucurbitaceae, Orchidaceae and the Sapotaceae are large families, the rest of the parts are composed of small families containing only one or two genera with few species.

The Cucurbitaceae deals with twenty-eight genera with one hundred and twenty-six species, most are herbaceous climbers and provide gourds, edible fruits and sponges, the loofah; some are extremely poisonous. An interesting one is *Cucumis humifructus* Stent, which actually buries its fruits in the ground and has been recorded from Nakuru, near Nairobi, then from the S.E. Congo, Zambia, Rhodesia, Angola and South Africa.

The Sapotaceae are mostly trees, some of economic importance from the timber point of view but the genus *Butryospermum* has an edible fat of economic importance

in West Africa and to a lesser extent in Uganda and is called Shea butter which is extracted from the ripe seeds. In East Africa this family is represented by thirteen genera and forty-five species.

The Orchidaceae (Part 1) covers all the terrestrial orchids recorded in East Africa. It has seventeen genera with four hundred and forty-three species, the largest genus being *Habenaria* with one hundred and thirteen species.

All the parts have keys to the genera and species and are well illustrated with line drawings and the high standard of production is maintained and the eight authors are to be congratulated on the completion of these fifteen families of the Flora of Tropical East Africa.

The parts are obtainable from the Government Printers in East Africa or from the Government Bookshops in the Provinces or London in the United Kingdom.

P. J. G.

A GUIDE TO SOME OF EAST AFRICA'S UPLAND FLOWERS

Kenya Shell Ltd. are to be congratulated on the publication of another Guide, this one on some of East Africa's Upland Flowers, a thirty-four page book of well produced coloured photographs of some of our very attractive flowers. There are sixty of them taken by Mr. R. Fulton who also supplied the native tribal lore about them and they cover trees, shrubs and herbs.

The photographs were identified by the East African Herbarium (E.A.A.F.R.O.) and Mrs. Tweedie, and each is labelled with its correct scientific name, its native names, as well as the English name if one is available, and a brief description about it and its native uses and in many cases the altitude at which it grows.

The cover is a full page photograph of a *Gloriosa* flower and the back one has three flowers of the "Black-eyed Susan," *Thunbergia alata*.

The reproduction of the photographs is very good and it is not easy to make a selection from them; I particularly like the *Clematis* and *Disa* photographs on page 18 and opposite page 22 there is a very fine one of a water-lily flower, *Nymphaea caerulea* in its natural habitat.

It is on sale for Shs. 6/- and is well worth the money. It is to be hoped that further guides to the wild flowers of other areas of East Africa will appear and give to those interested an idea of the very interesting and rich flora by which we are surrounded.

P. J. G

ORCHIDS OF EAST AFRICA

By Frank Piers, Verlag Von M.D., F.L.S., J. CRAMER 1968, 304 pages with 116 black and white photographs, a map and two coloured plates. Price £8. 5. 0 in paper covers.

This is the second and fully revised and enlarged edition of a book first produced in 1959 in cyclostyled form and of very limited distribution.

It is clearly stated in the preface that this new printed version is still intended as a practical guide for the naturalist, the orchid lover in particular, and even the intelligent tourist and makes no claim to be a scientific treatise. Those who want something more comprehensive can, for many of the ground orchids, already refer to the first volume of the orchids for the new Flora of Tropical East Africa and continue to look forward in hope or possibly despair to the subsequent volumes which will complete the family. Those interested in orchids in Uganda, and even in parts of Western Kenya and Western Tanzania will also be able to refer to Volume III Part 1 of the new edition of the Flora of West Tropical Africa for accounts of several species not to be found in this new book.

A great value of the new edition of Piers' book lies in the fact that there is nothing else that one can buy that covers the same ground. The amateur botanist will be glad to have descriptions of the plants that he can understand and use without recourse to a microscope. Nine times out of ten however orchids discovered in the field are not in flower and how useful it would have been to have some kind of field key based on environment and vegetative characters to enable provisional naming before flowering, though, if one already recognises the genus, the species descriptions will often make this possible. Plant hunters will sooner or later find species they are unable to identify from this book and one sad omission from the second edition is the listing of additional species and even a few genera not described in the text which often, using the earlier edition, enable one to run down less common plants such as *Zeuxine elongata* or *Microcoelia microglossa* which could both easily be identified from the Flora of West Tropical Africa once one had a lead to the names.

One suspects that the coverage of this book is very much more thorough for Kenya than for the other two countries. In Kenya there are even descriptions of several forms awaiting names at Kew. In contrast to this treatment of Kenya orchids, several quite well known Uganda species such as *Cyrtorchis injoloensis* which is illustrated, however I believe wrongly, on page 261 above the name *Cyrtorchis ringens*, and *Diaphananthe ugandensis* from Kigezi, are not mentioned at all, while other recently discovered rarities are alas given incorrect localities, *e.g. Rangaeris rhipsalisocia*, which is in fact only known in Uganda from a single collection in Budongo Forest and *Podangis dactyloceras* which so far as I know has never been found at or indeed anywhere near Entebbe and *Genyorchis pumila* which has only been found from a single tree, but *not* in Mpanga Forest, by Mr. Hermann Meyer. The first East African finding of *Polystachya affinis* was not by Mr. Leakey in fact but by Mr. Kamya of the Uganda Forestry Department. A number of well known Kenya orchids which are quite common in Uganda on the three eastern volcanic mountains Elgon, Kadam and Moroto, including *Rangaeris amaniensis*, *Diaphananthe quintasii*, and *Polystachya transvaalensis* receive no mention as occurring in Eastern Uganda. A comparison of the species described in Piers' book from Uganda and those listed as having known Uganda localities in the Flora of West Tropical Africa, for example the genus *Ancistrorynchus* (*A. recurvus*, *A. metteniae*, *A. capitatus*, *A. straussii* are all recorded for Uganda in addition to the well known *A. ovatus*) will make the relatively scant treatment of this area apparent, though one of the finest of these western species found in Uganda *Tridactyle gentilii* (de Wild.) Schltr. escapes mention for East Africa in the Flora of West Tropical Africa.

The account of *Nephrangis filiformis* appears possibly to embody a confusion between two quite unrelated species. I am not closely familiar with the distribution of this orchid in Kenya, but in Uganda it occurs only in the West, being nowhere common. It is found in the branches of the large trees in the canopy of Budongo and Kalinzuh Forests and occurs quite commonly at about 7,000-8,000 ft. on *Cupressus* trees beside a main road in Kigezi. On the other hand *Tridactyle tridentata* (var. *subulifolia*?) which has a superficially rather similar vegetative morphology and pendulous habit occurs very commonly and often in large clumps on large trees in areas near Lake Victoria in Kenya and Uganda in just the way that Piers describes for *Nephrangis*. Incidentally another terete leaved *Tridactyle*, *T. teretifolia*, is also quite common near the Western shores of Lake Victoria both North and South of the Tanzania border and is known to extend as far West as Kikagati near the Uganda–Rwanda border.

The author has based his book on his first hand knowledge as far as possible and this makes the coverage satisfactory only in the areas where the author is familiar with the orchid flora. It would seem that either more personal visits or more recourse to herbaria or more consultation with local botanists, or all of these, could have considerably improved the value of the book for areas beyond Dr. Piers's normal safari circuit. Nevertheless even at £8 .5 .0 anyone desiring to become familiar with East African orchids in the field should buy this book and by the time he senses its inadequacies too strongly it will already have achieved its purpose and the owner will then be using the Floras and Herbaria and not having to rely too much on this very useful introductory manual.

On page 14 there is a selective list of East African orchids recommended for cultivation and suggestions for their growth in Tropical, Intermediate or Cool conditions, with an added class of "difficult" species. The choice of the species is of course a personal one, though why the very drab *Bulbophyllum cochleatum* should be included is hard to understand. The arrangement of the classes of growing conditions has some peculiarities and bears little very obvious relation to the comparative ecology of many of the species in the wild nor in fact to their needs in cultivation. For example *Eurychone rothchildiana*, which grows in deep shade near water, in middle altitude forests on very few host species, if given suitable conditions for say *Aerides odorata* or *Angraecum giryamae* would assuredly die within days if not hours. While from a single tree near Entebbe I have collected growing together species from all four lists i.e. *Angraecum infundibulare*, *Rangaeris brachyceras Anragecopsis gracillima* and *Cirropetalum umbellatum*! It is very difficult to classify orchids satisfactorily by growing conditions. Some species will stand or adapt with care almost any conditions while others are far more demanding, particularly of humid conditions. Piers sometimes gives the altitude of known wild habitats of the plants— this is perhaps the most useful guidance to conditions for cultivation, provided that the information is read with adequate geographical background knowledge.

The book is nicely produced and printed and the photographs are useful and quite good, as indeed are the descriptions and accounts of most of the 271 spceies covered. In bringing this book to print and sharing his knowledge with us all Dr. Piers has made a notable contribution and earned our gratitude. C.L.A.L.

Printed by The English Press Ltd., P.O. Box 30127, Reata Road, Nairobi

JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. XXVIII No. 1 (119) JULY, 1970

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(Published October, 1970)
Price Shs. 25/-.

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All correspondence in connection with this journal should be addressed to:
The Secretary, East Africa Natural History Society,
P.O. Box 4486, Nairobi, Kenya.

SHALLOW SOILS AND THEIR VEGETATION IN THE REGION OF NAIROBI, KENYA

By

KISHOR L. MODHA

Uganda National Parks/ Nuffield Unit
of
Tropical Animal Ecology,
Queen Elizabeth Park, Uganda.

INTRODUCTION

Shallow-soil areas are here defined as those where up to 20 cm. of soil covers the underlying rocks (fig. 1), and eleven such areas were studied in the Nairobi National Park. The vegetation of these shallow-soil areas is not much disturbed by human activities such as cultivation and road-making, and is very sensitive to drought; it only grows after the rains, remaining dormant during the dry months of the year. The present study was therefore started soon after the beginning of the short rains in October, 1967. Elongated areas of shallow soils are usually found on the side of a valley or the shoulder of a profile following the contour in the position of maximum slope. In the Nairobi National Park such areas are found mainly in the western wooded part which has many river valleys, but some occur near the Observation Point and near Hippo Pool. Shallow-soil areas are bordered by grassland and woody vegetation on one side or on both upper and lower edges.

Sampling Procedure

From a random throw within a shallow-soil area two transects were considered, one down the slope and the other up the slope. Along these transects the position of each sample was obtained by stratified random sampling within each consecutive 10 m. length. The number of quadrats in a transect varied from three to nine, depending on the length of the transect.

Having found the position of the sample a quadrant of 1×1 m. was marked. A sample of soil was taken from each quadrant from a depth of about 2-3 cm. for pH determination and the occurrence of every plant species was recorded.

The depth of the soil was determined by pushing a metal rod down into the soil until it reached the underlying rock. The depth to which it sunk was measured. In the deeper soils, if the rocky base was not struck by the metal rod the depth was entered as "more than 70 cm."

Identification of plants was aided by the use of Heriz-Smith (1962).

Soil Acidity

It was found that the soil in general is slightly acidic—pH ranging from 6.4 to 7.0—with the majority of the sites having pH 6.6 or 6.8. There is apparently no relation between the pH and the soil depth and therefore none between the pH and the vegetation, since the vegetation depends on the soil depth.

Figure 1.—Examples of the profiles of sites of shallow soil as studied near Nairobi. The horizontal scale is approximate but the vertical scale is more exact of 1:20. Bedrock is shaded. Numbers refer to stratified random sample positions.

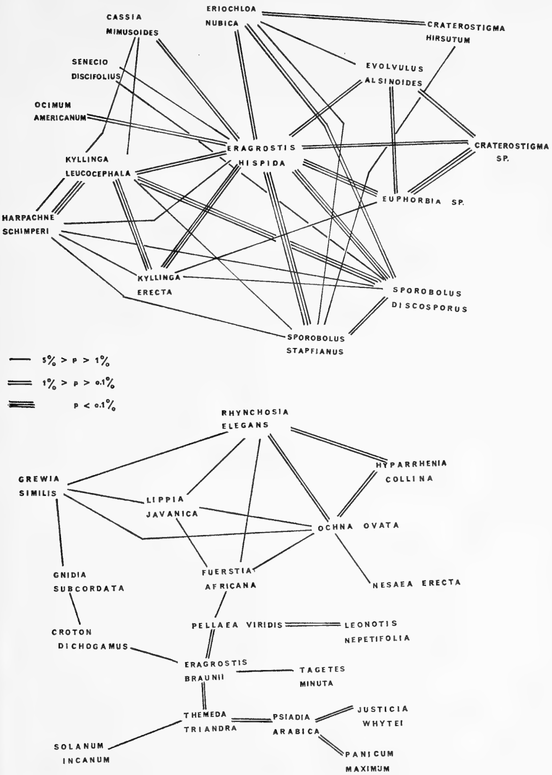

Figure 2.—Species diagram showing the relationships between species found on shallow and adjacent soils.

Comparison of samples

To find out if there is any significance of correlation among the species, the method adopted by Agnew (1961) was used. The species in each sample are treated on a presence or absence basis which consists of testing the correlation (positive or negative) of every species with every other by means of Chi (X^2) square. In this study only positive correlations were taken into account, because of the small number of samples finally obtained.

First of all, the data were reduced by eliminating all those species which occurred less than five times. This left 42 species. A table was prepared showing the occurrence of each species with every other. Then, by using 2×2 contingency tables, for each pair a chi-square value was calculated. The probability values were calculated from Fisher & Yates (1953).

For visual examination and appreciation of these correlations they were arranged as shown in Fig. 2, which is referred to as the "species diagram" (Agnew, 1961). It is a two-dimensional representation of positive correlations, the best possible arrangement being obtained by trial and error and it demonstrates some of the ecological relationships between species.

It is clear that some typical plants of the shallow-soil area show high positive correlations with each other, e.g. *Eragrostis hispida, Sporobolus discosporus, S. stapfianus, Kyllinga leucocephala, K. erecta, Euphorbia rivae, Evolvulus alsinoides, Craterostigma spp., Eriochloa nubica, Cassia mimusoides*, and *Harpachne schimperi*, these plants are ecologically related and always occur together on the shallow-soil area.

Woody shrubs and trees show higher positive correlations with each other and so form a group of their own as can be seen from the diagram. *Ochna ovata, Grewia similis, Croton dichogamus* and *Gnidia subcordata* are small trees which are found among shrubs like *Lippia javanica, Fuerstia africana, Nesaea erecta, Psiadia arabica* and grasses like *Eragrostis braunii, Hyparrhenia collina* and *Panicum maximum.*

These two groups are not connected on the diagram by a common link, so they are apparently ecologically separated groups of plants, and in nature they hardly, if ever, intermingle with each other.

Discussion

The following is a list of plants generally found in the shallow-soil area.

Anthericum gregorianum	*Fimbristylis spp.*
Cassia mimusoides	*Harpachne schimperi*
Coleus caninus	*Ilysanthes pusilla*
**Craterostigma hirsutum*	*Kyllinga erecta*
**Craterostigma* spp.	*Kyllinga leucocephala*
Cyperus spp.	*Oldenlandia herbacea*
Eragrostis hispida	**Sporobolus discosporus*
**Eriochloa nubica*	*S. stapfianus*
Euphorbia rivae	*Trachyandra saltii*
Evolvulus alsinoides	

The flora of the shallow soil is peculiar in that it contains a large proportion of poikilohydric species whose leaves dry up but do not die in dry months and become green as soon as they get wet; they flower soon after rain and again dry at the end of the rainy season. This property is an effective adaptation to the environment in these areas, and the poikilohydric species probably evolved in this habitat. They are marked with an asterisk in the list.

The woodland vegetation consists of small trees from 5-10 m. high. The most characteristic species are *Croton dichogamus*, *Dombeya burgessiae*, *Erythrococca bongensis*, *Gnidia subcordata*, *Grewia similis*, *Turraea mombassana*, *Strychnos usambarensis* and occasionally *Olea africana*. Of these *Croton dichogamus*, *Gnidia subcordata*, *Grewia similis* and *Turraea mombassana* are typically forest-edge trees. The dense ground flora up to about 50 cm. high usually consists of grasses, herbs like *Justicia whytei*, at times climbers like *Rhynchosia elegans*, and other dicotyledonous plants. Woodland in some places is closed; in others it is more open.

The grassland type of vegetation consists of the following species amongst others:

Aristida adoensis	*Pennisetum* spp.
Fuerstia africana	*Psiadia arabica*
Hyparrhenia collina	*Rhynchosia elegans*
H. filipendula	*Rhynchelytrum repens*
Justicia whytei	*Senecio discifolius*
Leonotis nepetifolia	*Setaria verticillata*
Lippia javanica	*Themeda triandra*
Panicum maximum	

The three types of vegetation often occurred in one transect, which was orientated simply to pass through the shallow-soil area (fig. 1), and no attempt was made to sample the vegetation types separately. The species diagram (fig. 2) shows that there are high positive correlations among the species of the shallow-soil and that these species form a "ring" which is quite separate from the other group of woody plants on the deeper soil. There are no intermediates which link the two types and this suggests that they are ecologically fundamentally separated.

The shallow soils studied here were presumably formed by the filling-in of depressions and crevices in bare rock, much of which remains in these area. Further weathering of the exposed rocks should add to the volume of soil, and one would expect more soil to accumulate as pioneer plant species colonize and consolidate it.

In a normal succession, as soil depth increases, the pioneer species are gradually and continuously replaced by woody perennials, but in our shallow-soil areas there is apparently a discontinuity between successional stages. They have developed a specialized and characteristic flora, whose species are different from those of the surrounding woodland and/or grassland, and which are apparently a permanent and regular feature of East African vegetation. As mentioned above, shallow-soil areas usually occupy positions on the shoulders or sides of valleys, and apparently here erosion is capable of maintaining the soil depth at under about 25 cm.

Throughout the study virtually no interaction was observed between the bigger animals and the shallow-soil vegetation. In one place shoots of *Anthericum gregorianum* and *Trachyandra saltii* had been nipped off as if eaten by some herbivore, probably a bushbuck, *Tragelaphus scriptus* (Callas), which was seen grazing in the vicinity. Other plants like *Craterostigma spp.*, *Cassia mimusoides*, *Evolvulus alsinoides*, *Ilysanthes pusilla*, *Euphorbia rivae* and *Oldenlandia herbacea* were not touched by the animals, because of either their small size or some unpalatable constituent. For reasons not known, some dwarf grasses like *Eragrostis hispida*, *Eriochloa nubica*, *Sporobolus discosporus*, and sedges like *Fimbfristylis spp.* and *Cyperus spp.*, were not touched either. The small size of these plants is perhaps an advantage to them, for herbivores may find it difficult to feed on small plants.

In the forest, the advantage of these shallow-soil areas could be that they would act as firebreaks as they would be devoid of combustible matter even in the dry seasons when the carpet of dried plants is too thin for fire to pass through.

SUMMARY

A study of shallow soils round Nairobi shows that the vegetation of these areas is not simply the first stage in a successional series, as one would expect, but a separate, specialized vegetation type discontinuous with neighbouring and successional communities. The vegetation of these areas is described and its biological significance discussed briefly.

ACKNOWLEDGEMENT

I am grateful to Dr. A. D. Q. Agnew for directing the study and for going through the manuscript; to the Director, Kenya National Parks for allowing supervised access to Nairobi National Park for this investigation; to the Botany Department, University College, Nairobi where this investigation was carried out; and to Mr. M. L. Modha for much discussion and advice.

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(Received October 1968)

THE DISTRIBUTION OF THE GENETS, *GENETTA GENETTA*, *G. SERVALINA* and *G. TIGRINA* IN EAST AFRICA

By

M. E. TAYLOR,

Department of Zoology, University of Toronto, Toronto, Canada

INTRODUCTION

There are three species of genet in Kenya: *Genetta genetta* (Matschie), *G. servalina* (Thomas) and *G. tigrina* (Matschie). Of these *G. tigrina* is by far the commonest and is composed of two indistinct subspecies, *G. tigrina erlangeri* (Matschie) and *G. tigrina stuhlmanni* (Matschie). In this account the genets are treated at species level. *G. genetta* is a light coloured animal, the background colour being a dirty white, while *G. tigrina* has a much darker coloration; *G. servalina* has a yellowish-brown background colour with far more numerous markings. It is rare in Kenya, living in the remaining thick forests of western Kenya. The most recent record is from the Kakamega forest, collected in 1955. It is commoner in the forests of Uganda, several animals being caught in the Budongo forest in western Uganda in the last three years.

Records

Most of the data have been collected from trapping results, though additional information has been accumulated from road deaths and occasional sightings. The material in the National Museum, Nairobi, has been consulted and all the information to date includes *about* 200 records. There is virtually no information on the distribution of genets in the outlying districts of Kenya. The scatter of the collecting points reflects the road network, and also the number of collectors in the proximity of Nairobi. Fig. 1 shows the collecting results up to December 1968, with the approximate 63.5 cm.-162.5 cm. (25 and 65 in.) rainfall contours.

Most of the *G. genetta* records are from areas with less than 63.5 cm. (25 in.) of rain a year. They may be found in a few localities with a slightly higher rainfall, there being an overlap with *G. tigrina* in some places. Examples of this possibly sympatric association have been noted at Ulu, Sultan Hamud and Voi; these areas have high and low rainfall regions. *G. tigrina* occurs in the wetter areas though these genets are not found in thick forests or at altitudes over 3048 m. (10,000 ft.) *G. servalina* occurs in wet forests with a rainfall of over 162.5 cm. (65 in.) a year.

Walker (1964) refers to the frequency of melanistic genets, and they are certainly common in parts of Kenya. There are many records from the vicinity of Nairobi, though this reflects the number of collectors in the Nairobi region. Melanistic individuals are also recorded from parts of the Kinangop, Naivasha and the Mau Escarpment. All these

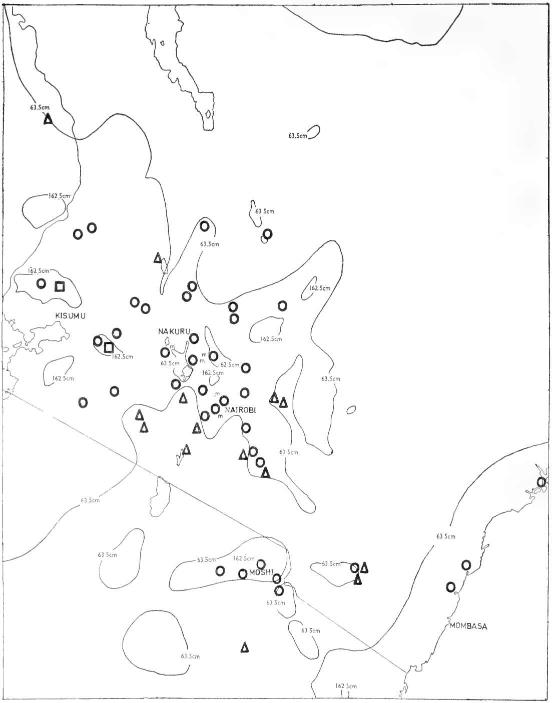

Fig. 1.—Distribution of the genets in East Africa. *G. genetta* △; *G. servalina* □ and *G.tigrina* O Melanistic animals are indicated (m). The symbols indicate one or more animals from an area. The approximate 63.5 cm (25 in.) and 165 cm. (65 in.) rainfall contours are estimated from the Mean Annual Rainfall Map for East Africa produced by the Overseas Survey, 1955.

animals are *G. tigrina* and are indicated (m) in Fig. 1. There are no records of melanistic *G. genetta.*

Summary

The distribution of the three species of genet is related to rainfall. *G. genetta* is essentially a dry country animal, occuring in regions with less than 63.5 cm. (25 in.) of rain a year. *G. tigrina* occurs in wetter regions, with a rainfall between 63.5 cm. and 162.5 cm. (25 and 65 in.) and *G. servalina* is found in regions with rainfall exceeding 162.5 cm. (65 in.) a year.

ACKNOWLEDGEMENT

I would like to thank all those people who have trapped animals for me and brought in corpses from the roads. I am also very grateful to Dr. L. S. B. Leakey for his continual help with this collecting programme.

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(Received 11th December 1968)

A NEW FOUR-TOED MONGOOSE FROM KENYA, *BDEOGALE CRASSICAUDA NIGRESCENS* ssp. nov.

By

John B. Sale

(Department of Zoology, University College, Nairobi)

and

Mark E. Taylor

(Department of Osteology, Centre for Prehistory and Palaeontology, National Museum, Nairobi)*

INTRODUCTION

The four-toed mongooses belong to the African genus *Bdeogale* Peters. The genotype, *Bdeogale crassicauda*, was described by Peters in 1852 and currently contains four sub-species. They are distributed through central Mozambique, Malawi and Zambia (*B.c. crassicauda* Peters 1852); northern Mozambique and southern Tanzania (*B.c. puisa* Peters 1852); Zanzibar Island (*B.c. tenuis* Thomas & Wroughton 1908); and northern coastal Tanzania and Kenya (*B.c. omnivora* Heller 1913), according to Coetzee (1967). In addition, most recent authorities (Walker, 1964; Coetzee, 1967) regard *Galeriscus* Thomas as a sub-genus of *Bdeogale*, containing the species *B. nigripes* Pucheran (1855) and *B. jacksoni* Thomas (1894). A new sub-species of *B. crassicauda* is described in this paper and the sub-specific name *nigrescens* proposed.

During a period of mammal trapping by the senior author in February, 1965, a number of specimens of an unfamiliar type of *B. crassicauda* were live-trapped at Lukenya, Kenya. Two of these animals were kept under observation in captivity in Nairobi for several months. Investigations showed that this form of *Bdeogale* did not correspond to existing descriptions of sub-species of the genus but further comparison and description were precluded when the animals escaped from captivity. A further seven specimens were trapped in the same locality during November/December 1967. One animal was kept alive in captivity until April 1968 and three, which were prepared as museum specimens (skull and skin), form the basis of the present description of a new sub-species.

Unfortunately the type specimens of *B.c. crassicauda* and *B.c. puisa* were destroyed by bombs in 1945 while in the Berlin Museum, therefore impossible to compare the new material with these. The holotype of the new sub-species was, however, compared with British Museum examples of *Bdeogale*, viz three specimens of *B.c. crassicauda*, four of *B.c. tenuis* and one of *B.c. puisa*. It was also compared with the type specimen of *B.c. omnivora* (a female) in the United States National Museum. In addition, comparison was made with three specimens of *B.c. omnivora* in the National (formerly Coryndon) Museum (C.M.M.), Nairobi and a further three specimens collected by the junior author from the Sokoke Forest, near Gedi on the Kenya coast.

* Present address: Department of Zoology, University of Toronto, Ontario, Canada

TYPE LOCALITY

The holotype and both paratypes used in the present description were trapped around the base of Lukenya Hill 37 km south-east of Nairobi, immediately to the north of the Nairobi-Mombasa road. Lukenya is a 3 km long ridge of metamorphic Basement System rock running north-east to south-west and rising 60 m. above the surrounding dry savanna (altitude 1840 m.). The vegetation around the base of the hill is grassland with scattered shrubs and trees, especially *Acacia spp.* and *Commiphora africana* (A. Rich.) Engl. There are also grasses on the hill itself, many rambling herbs such as *Cissus quadrangularis* L. and *Sarcostemma viminale* R. Br. and a variety of shrubs but only an occasional tree. In particular *Ficus spp.* are found growing among the rocks. Lukenya is a typical Klipspringer (*Oreotragus oreotragus* Neumann) habitat and a number of pairs of this koppie-dwelling antelope are found there.

Numerous bare outcrops protrude from the sides of the hill and around the bases of these and the many boulders which are strewn around, holes and crevices of a variety of sizes provide excellent shelter for a host of small mammals. Of particular note is the fact that the new sub-species of *B. crassicauda* is found sharing a habitat with four other similar sized carnivores (one mustelid and three viverrids), viz Zorilla (*Ictonyx striatus* Perry); Genet (*Genetta tigrina* Matschie, see Taylor, 1969); Black-tipped Mongoose (*Herpestes sanguineus* Rüppell) and White-tailed Mongoose (*Ichneumia albicauda* G. Cuvier). During a study of viverrids, the junior author has found this type of situation to be quite common.

Attempts to find specimens of *B.c. nigrescens* in other localities up to 80 km from Lukenya have so far been unsuccessful. One report exists of a similar mongoose being seen at Athi River about 8 km from Lukenya. The type locality of *B.c. omnivora* is Mazeras, approximately 450 km south-east of Lukenya near the Kenya coast. There appear to be no records of either *B.c. omnivora* or *B.c. nigrescens* between the two type localities but extensive trapping of this large area has yet to be carried out.

The new sub-species appears to be geographically isolated from other known localities of the species. This marked isolation provides good additional evidence for designating the Lukenya form as a distinct sub-species.

DESCRIPTION OF THE NEW SUB-SPECIES

The holotype is an adult male, number BM 68.1103, in the British Museum (Natural History). It was collected by the authors on 24 November 1967.

Two paratypes are being designated as follows:

Paratype 1: an adult male, number C.M.M. 7512, in the National Museum, Nairobi, collected by the authors on 6 December 1967.

Paratype 2: an adult male, number C.M.M. 7513, in the National Museum, Nairobi, collected by the authors on 7 December 1967.

The name proposed for the new sub-species is *Bdeogale crassicauda nigrescens*, on account of the very dark, almost black, coat that distinguishes it from other members of the species.

General features

The new sub-species is a medium-sized, four-toed mongoose with a very dark, almost black, glossy coat and a short bushy tail. The head is rather rounded for a viverrid, giving the appearance of a relatively short muzzle (Fig. 1). Like other members of the species this animal is markedly docile and lacks the aggressive nature of the majority of viverrids when first caught.

Weight and external measurements (see Table 1)

Unfortunately the weights of the older museum specimens of the genus were not taken. The weight of the new form is much greater than that of recently collected *B.c.omnivora* from the Kenya coast (average 907 g.) although the difference between the body lengths of these two genera is not very great (see below).

The head and body length of *B.c. nigrescens* is intermediate between *B.c.puisa*, which is longer, and *B.c. crassicauda*, *B.c. tenuis*, and *B.c. omnivora* which are shorter. Of the four existing sub-species, the new form is nearest to *B.c. omnivora.* The tail length of *nigrescens* is shorter than all the others except *tenuis* but it is not clear how the tail lengths of the earlier type specimens were obtained. Our own tail measurements for the new sub-species were measured dorsally between the last sacral vertebra and the tip of the last caudal vertebra. The *ratio* of tail length to head and body length is less in the new form than that of the types of *crassicauda* and *omnivora* and similar to those of *puisa* and *tenuis*.

Skull measurements (see Table 1)

The skull of *B.c. nigrescens* is greater than that of *B.c. tenuis* in all measurements recorded in Table 1. Conversely, it is less than *B.c. puisa* in all dimensions except the distance between the orbit and the ant-orbital foramen, in which respect the new form is greater. In some dimensions, especially the condylo-basal length, the new form is similar to *B.c. omnivora.* However, greatest similarity is shown with *B.c. crassicauda*, where the only significant difference is in the greater condylo-basal length of the latter.

Coat characteristics (see Table 2)

As seen from the summary in Table 2, *B.c. nigrescens* is distinguished by having a generally darker coat than the other sub-species. In particular, the back and tail (which is completely black dorsally) are very dark due to a preponderance of long guard hairs, of which at least the distal portion is a shiny black. The coat of the living animal presents a much blacker appearance than the museum skin, due to the fact that in the former the

TABLE 1

Measurements (in g. and mm) of the five ssp. of Bdeogale crassicauda

	puisa	*crassicauda*	*tenuis*	*omnivora*	*nigrescens* Holotype	*nigrescens* Paratype 1	*nigrescens* Paratype 2
Weight	—	—	—	—	1580	1575	1500
Head and body length	500	400	410	420	432	443	473
Tail length	250	300	180	245	232	200	210
Hind foot	75	84	70	81	74	82	75
Ear	—	—	20	34	32	30	32
Condylobasal length	87.5	87.9	80.8	85	85.4	82.2	83.4
Zygomatic width	48.5	47.4	44.1	46	46.4	44.6	48.3
Interorbital width	20.6	18.4	16.4	18	19.4	18.2	19.2
Post-orbital constriction	16.6	16.5	14.5	14	16.3	15.7	15.6
Palate length	48.9	49.2	45.0	50	49.5	47.8	47.8
Palate width at M_1	27.8	26.9	25.2	—	27.6	26.5	28.0
Upper tooth row length	38.2	38.5	35.2	40	37.9	36.6	38.2
M_1 width	7.0	7.0	5.9	7	6.8	6.4	6.9
Distance between orbit & ant-orbital foramen	3.6	4.5	2.3	—	3.9	4.3	4.0

TABLE 2

Coat characters of the five sub-species of Bdeogale crassicauda.
Numbers in brackets indicate hair length in mm.

Body Region	*B.c.puisa*	*B.c.crassicauda*	*B.c.tenuis*
Throat	1. Curly hairs, silvery brown. 2. Guard hairs light brown banded with white.	1. Curly hairs light brown. 2. Guard hairs dk. chocolat brown, whitish brown nr. base.	1. Curly hairs as long as guard hairs rich orange brown; no distinct banding. 2. Rich orange brown, (6).
Ventral Thorax	1. Silvery to buff. 2. Mid brown, with or without white bands, tip always mid brown	1. Silvery hairs, not banded. 2. Darker than *puisa*, majority not banded.	1. Long, straw coloured tinged with orange. 2. Dark brown tips for 2/3 to ½ length, base light yellow-brown as in curly hairs, (7).
Ventral Abdomen	1. Silvery light brown and not banded. 2. Cinnamon to mid brown, banded all similar colour.	1. Uniformly matt brown with silverish tinge. 2. Shiny black to very dark brown, may be banded white in the mid third.	1. Uniform light yellow to light brown. 2. Few guard hairs, mid brown with lighter base and roots, (19).
Dorsal Head	1. Not present in any numbers. 2. Short, mid brown, with two white bands, always brown at tip.	1. Uniformly light brown. 2. Slightly longer than *puisa*, black tipped then white band, dk. brown band, white band & darker root.	1. Light yellow to orange, almost as long as guard hairs. 2. Tip dk. brown with reddish tinge for ½ length, then light straw band to roots, (9).
Back	1. Longer than on head, and light brown. 2. Dark tip, light brown band, dk. brown band, white band, mid brown root, (29)	1. Uniformly light brown. 2. Dark black tip for ½ length then white band for 1/6 and then darker region to root, though may be white cont. to root. (46).	1. Very thick underfur, chocolat brown, long. 2. Rich brown for most of length, lighter brown at base, (30).
Flank	1. Curly hairs dense, uniform light cinnamon. 2. Lighter than back due to shorter dark bands. May be three straw coloured or white bands between the dk. brown zones.	1. Uniformly light brown. 2. Long dark tip, virtually black, may only have one light band. (40).	1. Very thick underfur, predominately brownorange. 2. Rich brown. Basal ¼ is an orange to light yellow, (30).
Feet	1. Uniformly light brown. 2. Short guard hairs, chocolat brown except for white base.	1. Few curly hairs, light brown. 2. Slightly longer than curly ones, and dk. brown.	1. Uniformly light yellow, thinly distributed. 2. Chocolat brown with orange brown base, (3).
Tail: Basal 1/3	DORSAL 1. Light with dk. brown tips, one or two mid brown bands, on the whole light coloured. 2. Tip 2/3 dk. brown to black, basal 1/3 white, brown and a white or brown base. (44). VENTRAL 1. White to straw colour, slightly darker tip. 2. Black tip ½ to 1/3 the length then white, brown, white, brown bands, (45).	DORSAL 1. Whitish yellow to light brown, no distinct banding. 2. Tip 2/3 black, then white band and black to root, (50). VENTRAL 1. Uniformly straw coloured. 2. Black tip for 2/3, then white band, or the white may be continuous to base. (43).	DORSAL 1. Definite orange curly hairs in quite large numbers. 2. Tip 2/3 reddish dk. brown to black, (24) VENTRAL 1. Light orange yellow, sometimes with a black tip. 2. Tip ½ to 2/3 shiny black to dk. brown; basal region orange (27).
Tail: Middle 1/3	DORSAL 1. Very fine, straw coloured. 2. Tip 2/3 black brown with reddish tinge, then straw coloured band, dk. brown, white roots, (45). VENTRAL 1. Fine straw coloured. 2. Tip 2/3 brown black with reddish tinge, (51).	DORSAL 1. Yellowish brown, may have a darker tip. 2. Distal 2/3 black, white band brown black band with white root, (51). VENTRAL 1. Dark tip, general colour mid to light brown. 2. Completely black, may be lighter band near root, (53).	DORSAL 1. Orange, uniform, may be darker at tip. 2. Shiny brown black, may have a slightly lighter band nearer the root, (50). VENTRAL 1. Numerous orange yellow hairs. 2. Orange yellow, may have a light band 1/5 to 2/5 from base.

Body Region	*B.c.omnivora*	*B.c.nioriscens (Holotype)*	*Remarks*
Tail Distal 1/3	DORSAL 1. Usually banded, of various lengths. 2. Slightly curly, not straight reddish dk. brown, may have a light coloured base, (51). VENTRAL 1. Light brown, may be slightly banded. 2. Slightly curly, black tips merging imperceptibly to a more reddish brown near base, white near roots, (52).	DORSAL 1. Few curly hairs, mid brown. 2. Slightly curly to straight, virtually black, no light bands, (49). VENTRAL 1. Mid brown, slightly banded with a darker brown. 2. Uniformly black.	DORSAL 1. Fewer curly hairs, uniformly dirty orange. 2. Blackish to dark brown, (44). VENTRAL 1. Dirty orange yellow colour. 2. Black with only a short region near base which is lighter, (50).
Throat	1. Entirely golden yellow. 2. Golden yellow, no longer than curly hairs. (8).	Mixture of curly and guard: Various colour types. (a) Basal 2/3 light yellow, terminal 1/3 black. (b) Entirely light yellow. (c) Basal 1/3 dk. brown or black, mid 1/3 light yellow, terminal 1/3 black. 2. Guards hairs similar, (10)	Only *nigriscens* has black tipped hairs. *omnivora* is very distinctly golden yellow.
Ventral Thorax	1. Thin curly type predominant, all yellow, some darker at tips. 2. Entirely dark brown, a few with yellow bases, (15).	1. Entirely brown. 2. Entirely dark brown.	Underfur in *nigriscens* is darker than other species.
Ventral Abdomen	1. Predominantly light yellow. 2. Entirely dark brown, (15).	1. Curly hairs predominant, (a) yellow, (b) brown. 2. Black tip and yellow base. (25)	*nigriscens* darker than others.
Dorsal Head	1. Light yellow throughout 2. Black tips ½, white bases ½, (8).	1. Yellow/brown, many with black tips. 2. Long than *omnivora*, black tips, middle white, black base, (10).	Much darker in *nigriscens* than *omnivora* and *tenuis*.
Back	1. Uniformly light yellow. 2. Two types: (a) black through out: (b) short black tip, light yellow middle, black band, white base. (30).	1. Some yellow but mostly brown 2. Dark brown to black, except root which is golden yellow, a few with yellow middle portion, (35).	*nigriscens* is darkest of all, due to large number of long black guard hairs. More guard hairs than *crassicauda*. *puisa* is more obviously banded than *nigriscens*.
Flank	1. Uniformly light yellow. 2. Short black tips, broad white band, black or white root, (25).	1. Uniformly dark brown. 2. Long black tips, white band, dk. band, light root, (30).	Flank of *nigriscens* not so dark as back.
Feet	1. Mid brown tip ½, light yellow base. 2. Dark brown except for light coloured roots, (5).	1. Mid brown. 2. Short guard hairs, dark brown throughout.	All tend to dark brown feet.
Tail: Basal 1/3	DORSAL 1. Black tips, long light yellow region, + dark base. 2. High proportion of long guard hairs, long black tips, some lighter at base. (40). VENTRAL 1. Light yellow throughout. 2. Dark brown tip, wide yellow band, mid brown band, white root variable, (30).	DORSAL 1. Black tipped, light yellow, dark brown base. 2. Very long guard hairs, dark brown to black: basal ¼ light and then with dark base, (65). VENTRAL 1. Long black tip, light yellow band, dark roots. 2. Terminal ½ or more, black, base light yellow, (65).	Tail of *nigriscens* black right to base dorsally; lighter ventrally at base. The *crassicauda* guard hairs have a purplish tinge which is not present in *nigriscens*. *nigriscens* has longer guard hairs than other species.
Tail: Middle 1/3	DORSAL 1. Long, predominantly light yellow, some slightly banded. 2. Mainly long. Uniformly dark brown/black, base light yellow or golden yellow/brown, (40). VENTRAL 1. Tips mid brown, long light yellow region, long brown, light yellow base. 2. Shiny black for 4/5 length, basal 1/5 light yellow, (40).	DORSAL 1. Uniformly light yellow to mid brown. 2. Shiny black with or without light yellow bases, (60). VENTRAL 1. Tip light brown, rest light yellow. 2. Entirely shiny black, some with mid brown bands. (60).	All guard hairs dark brown or black ventrally except *tenuis*, which is not distinctly banded and has short guard hairs. *nigriscens* has longest guard hairs.
Tail Distal 1/3	DORSAL 1. Very few: terminal 1/3 brown, basal 2/3 light yellow. 2. Black tips, may be black or yellow, (40). VENTRAL 1. Very few, terminal third brown, basal 2/3 light yellow. 2. Black, some have white base, others are yellow except for black tip	DORSAL 1. Yellow brown throughout. 2. Dark brown to black with paler root, (55). VENTRAL 1. Few hairs, yellow brown with darker tip in some cases. 2. Shiny dark brown, brown yellow base, (55).	All guard hairs dark brown or black at tip. *nigriscens* has longest guard hairs.

guard hairs are at least partially erected, their black tips tending to hide their lighter bases and the yellowish brown underfur. The flanks and belly are progressively less dark due to the relatively lower density of black guard hairs in these regions.

The tail of *B.c. nigrescens* is very distinctive, being broad compared with its length. It has a very dense covering of black hairs, particularly dorsally, which give it a "bottle-brush" appearance when the hairs are erected in the live animal.

Biology

From trapping records and the fact that hardly anyone seems to have seen them in the wild, *B.c. nigrescens* would appear to be a nocturnal animal. In captivity it may become diurnal, though on the whole it remains nocturnal. It seems likely from the nature of the type locality, that it shelters in well-hidden holes in the rocks during daytime. Its narrow, only slightly curved claws do not suggest that the new sub-species is adapted for extensive digging, though it may well scrape up insect larvae from the surface layers of the soil. Moreover, its timid, docile nature indicates a shy animal that spends the daylight hours in strict seclusion.

All museum specimens obtained to date have been live-trapped and killed later, so that there is no information on diet from stomach content analyses. However, the animals kept in captivity did show certain food preferences. They would not eat bananas, mangoes or avocado pears and found difficulty in breaking open a chicken's egg. When the egg was previously broken, however, they lapped up the contents quickly. Their basic food was raw meat which was cut up into chunks and mixed with bone meal and multi-vitamins. One of the captive animals was also fed with wild young rats, live-trapped. It was very slow in catching them and did not appear to know how to kill them, seizing these rodents by the tail or back and then finally killing them by biting the back of the skull. One of the captive *nigrescens* was fed a 100 cm long stripe-bellied sand snake (*Psammophis subtaeniatus* Werner) which it soon killed and ate. This may indicate that the new sub-species feeds more on lizards and snakes than rodents, though its main food is probably insects.

ACKNOWLEDGEMENTS

Especial thanks are due to Dr. G. Corbet of the British Museum and Dr. Henry W. Setzer of the U.S. National Museum, both of whom kindly compared our specimens with material in their respective institutions. Mr. B. Lawrence-Brown, on whose property at Lukenya the animals were trapped, has been most helpful and we wish to record our gratitude to him. The senior author is grateful for funds provided by the Ford Foundation. Thanks are also due to Dr. L. S. B. Leakey for encouragement with this work and for providing funds to enable the junior author to examine material in Berlin and London.

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(*Received 17th April, 1969*).

BIRD RINGING REPORT 1968-1969

By

G. C. Backhurst

INTRODUCTION

This report covers the period 1 July, 1968 to 30 June, 1969. It is pleasant to report that, once again, the number of birds ringed is higher than ever before. As was hinted in last year's report (Backhurst, 1969*b*) some experienced ringers joined the scheme towards the end of 1968 while another came out early in 1969.

The full list of birds ringed is given in Table 1; the birds which are palearctic migrants are printed in bold type, others which are included in the palearctic fauna but which are also ethiopian are not so distinguished. The nomenclature used follows White (1960, 1961, 1962, 1963, 1965), a departure from previous reports but one that is considered desirable since White's lists reflect modern ideas more accurately than do the north-eastern parts of Mackworth-Praed & Grant's Handbook; moreover White's lists are to be the basis of the forthcoming AFRING list of birds (C. C. H. Elliott, *pers. comm.*).

The number of recoveries, Table 2, shows a satisfying increase. Birds ringed in previous seasons and retrapped at or near their original ringing sites are listed in Table 3.

SOME NOTES ON RINGING IN EAST AFRICA

Most birds were ringed in Kenya, a few hundred in Uganda and none at all in Tanzania. Fifteen ringers were operating in the two countries this season; most of the ethiopian species were ringed in western Kenya by P.L. & Mrs. H. A. Britton and J. F. & Mrs. L. M. Harper; smaller numbers were ringed in western Uganda by Dr. M. P. L. Fogden. Most of the ducks and waders were ringed at Lake Nakuru and at Naivasha by the Brittons, Harpers, Dr. E. D. Steel and G. C. & Mrs. D. E. G. Backhurst. Hirundines were ringed at Nairobi, Nakuru and in western Kenya.

The bulk of the Yellow Wagtails *Motacilla flava* were ringed at Nairobi and Kabete by the combined efforts of the Misses J. & D. Angwin, Mrs. L. Campbell, Dr. Steel and the Backhursts; work is progressing on a separate report on this species (Backhurst, in prep.).

One palearctic species, the Pintail Snipe *Gallinago stenura* ringed at Naivasha, was new for the Kenya list (Backhurst, 1969*a*); another palearctic wader, the Long-toed Stint *Calidris subminuta* caught at the same marsh at Naivasha during ringing operations, although not ringed, was also new for the national list (Backhurst & Britton, 1969). An example of the European Wryneck *Jynx torquilla* was ringed at Ng'iya in western Kenya, another first record for the country (Britton & Harper, 1969).

Britton & Harper (*loc. cit.*) record the occurrence of eight ethiopian species and one subspecies new to Kenya; three of these species have been recorded before in Kenya but with no supporting evidence. The new birds are: Blue-breasted Bee-eater *Merops variegatus*, Yellow-fronted Tinker-Bird *Pogoniulus chrysoconus*, White-winged Warbler *Bradypterus graueri*, Yellow Swamp-Warbler *Chloropeta gracilirostris*, Northern Brown-throated Weaver *Ploceus castanops*, Black Bishop (Uganda race) *Euplectes gierowii ansorgei*, Brown Twin-Spot *Clytospiza monteiri*, Black-rumped Waxbill *Estrilda troglodytes*, and Bar-breasted Fire-Finch *Lagonosticta rufopicta*.

ACKNOWLEDGEMENTS

Ringers gratefully acknowledge the co-operation of the City Engineer, Nairobi, for allowing them to operate at the two sewage works; the Director of the Kenya National Parks for permission to ring at Lake Nakuru; the Director of Veterinary Services, Kenya for permission to ring at Kabete; and to Mr. Douros for allowing ringers to operate on his land at Kabete. My wife gave me invaluable help in ringing and administrative tasks.

The Society is grateful to the Director of the National Museum, Nairobi, for allowing the Museum's address to appear on the rings.

TABLE 1

BIRDS RINGED BY THE EAST AFRICA NATURAL HISTORY SOCIETY RINGING ORGANISATION

Palearctic migrants in bold type.

	1968/9	Grand Total
Podiceps ruficollis (Pallas), Little Grebe	0	1
Ardeola ibis (L.), Cattle Egret	1	1
A. ralloides (Scopoli), Squacco Heron	1	1
Phoenicopterus minor Geoffroy, Lesser Flamingo	5	11
Platalea alba Scopoli, African Spoonbill	0	73
Threskiornis aethiopica (Latham), Sacred Ibis	0	7
Anas capensis Gmelin, Cape Wigeon	95	115
A. erythrorhynchos Gmelin, Red-billed Duck	0	43
A. hottentota Eyton, Hottentot Teal	57	91
A. querquedula L., Garganey	6	7
A. undulata Dubois, Yellow-billed Duck	5	36
Netta erythropthalma (Wied), African Pochard	1	4
Accipiter badius (Gmelin), Shikra	3	3
Milvus migrans migrans (Boddaert), Black Kite	1	1
Falco biarmicus Temminck, Lanner	2	2
F. subbuteo L., Hobby	3	3
Coturnix coturnix africana Temminck & Schlegel, Quail	0	1
C. delegorguei Delegorgue, Harlequin Quail	1	1
Fulica cristata Gmelin, Crested Coot	1	16
Gallinula chloropus (L.), Moorhen	1	1
Porphyrio porphyrio (L.), Purple Gallinule	2	2
Charadrius asiaticus Pallas, Caspian Plover	1	1
C. dubius Scopoli, Little Ringed Plover	10	17
C. hiaticula L., Ringed Plover	32	74
C. leschenaultii Lesson, Great Sand Plover	5	9
C. mongolus Pallas, Mongolian Sand Plover	2	4
C. pallidus Strickland, Chestnut-banded Sand Plover	0	100
C. pecuarius Temminck, Kittlitz's Sand Plover	30	136
C. tricollaris Vieillot, Three-banded Plover	10	19
Vanellus armatus (Burchell), Blacksmith Plover	52	97
V. spinosus (L.), Spurwing Plover	6	11
Dromas ardeola Paykull, Crab Plover	0	2
Cursorius chalcopterus Temminck, Violet-tipped Courser	0	1
Glareola pratincola (L.), Pratincole	1	1
Larus cirrocephalus Viellot, Grey-headed Gull	4	4
Sterna leucoptera Temminck, White-winged Black Tern	0	89
S. nilotica (Gmelin), Gull-billed Tern	0	3
Himantopus himantopus (L.), Black-winged Stilt	7	14
Recurvirostra avosetta L., Avocet	0	6
Rostratula benghalensis (L.), Painted Snipe	3	3
Calidris alba (Pallas), Sanderling	0	1
C. ferruginea Pontoppidan, Curlew Sandpiper	21	96
C. minuta (Leisler), Little Stint	668	1481
C. temminckii (Leisler), Temminck's Stint	2	7
Gallinago gallinago (L.), Snipe	20	22
G. nigripennis (Bonaparte), African Snipe	25	28
G. stenura (Bonaparte), Pintail Snipe	1	1
Philomachus pugnax (L.), Ruff	1017	1574
Tringa glareola L., Wood Sandpiper	280	324
T. hypoleucos L., Common Sandpiper	27	57
T. nebularia (Gunnerus), Greenshank	1	5
T. ochropus L., Green Sandpiper	9	9
T. stagnatilis (Bechstein), Marsh Sandpiper	142	327
T. terek Latham, Terek Sandpiper	1	4
Streptopelia capicola (Sundevall), Ring-necked Dove	7	7
S. decipiens (Finsch & Hartlaub), Mourning Dove	8	8
S. senegalensis (L.), Laughing Dove	1	1
Turtur afer (L.), Blue-spotted Wood Dove	18	18
T. chalcospilos (Wagler), Emerald-spotted Wood Dove	4	6
T. tympanistria (Temminck & Knip), Tambourine Dove	10	15

	1968/9	Grand Total
Centropus superciliosus Hemprich & Ehrenberg, White-browed Coucal	2	2
Chrysococcyx caprius (Boddaert), Didric Cuckoo	8	8
C. cupreus (Shaw), Emerald Cuckoo	1	1
C. klaas (Stephens), Klaas' Cuckoo	4	4
Glaucidium tephronotum Sharpe, Red-chested Owlet	1	1
Caprimulgus climacurus Vieillot, Long-tailed Nightjar	3	3
C. fossii Hartlaub, Gabon Nightjar	0	1
C. poliocephalus Rüppell, Abyssinian Nightjar	1	1
Macrodipteryx longipennis (Shaw), Standard-wing Nightjar	1	1
Apus affinis (Grey), Little Swift	0	162
A. caffer (Lichtenstein), White-rumped Swift	2	2
Colius macrourus (L.), Blue-naped Mousebird	12	12
C. striata Gmelin, Speckled Mousebird	67	67
Alcedo cristata Pallas, Malachite Kingfisher	50	50
Ceryle rudis (L.), Pied Kingfisher	15	28
Ceyx picta (Boddaert), Pigmy Kingfisher	46	50
Halcyon chelicuti (Stanley), Striped Kingfisher	4	4
H. leucocephala (Müller), Grey-headed Kingfisher	4	4
H. senegalensis (L.), Woodland Kingfisher	8	8
Merops albicollis Vieillot, White-throated Bee-eater	3	3
M. apiaster L., Bee-eater	1	1
M. bulocki bullockoides Smith, White-fronted Bee-eater	4	4
M. pusillus Müller, Little Bee-eater	1	1
M. superciliosus L., Blue-cheeked Bee-eater	1	1
M. variegatus Vieillot, Blue-breasted Bee-eater	2	2
Upupa epops L., Hoopoe	0	1
Gymnobucco bonapartei Hartlaub, Grey-throated Barbet	0	1
Lybius bidentatus (Shaw), Double-toothed Barbet	7	7
L. guifsobalito Hermann, Black-billed Barbet	1	1
L. lacrymosus (Cabanis), Spotted-flanked Barbet	23	23
L. leucocephalus (Defilippi), White-headed Barbet	6	6
Pogoniulus bilineatus (Sundevall), Golden-rumped Tinker-Bird	7	11
P. chrysoconus (Temminck), Yellow-fronted Tinker-Bird	8	8
P. leucomystax (Sharpe), Moustached Green Tinker-Bird	1	1
P. pusillus (Dumont), Red-fronted Tinker-Bird	2	2
Trachyphonus purpuratus Verreaux, Yellow-billed Barbet	1	3
Indicator indicator (Sparrman), Greater Honey-guide	7	7
I. minor Stephens, Lesser Honey-guide	9	9
I. variegatus Lesson, Scaly-throated Honey-guide	1	1
Campethera nivosa (Swainson), Buff-spotted Woodpecker	2	3
C. nubica (Boddaert), Nubian Woodpecker	6	6
Dendropicos fuscescens (Vieillot), Cardinal Woodpecker	4	4
Jynx torquilla L., Wryneck	1	1
Mesopicos goertae (Müller), Grey Woodpecker	3	5
Mirafra africana A. Smith, Rufous-naped Lark	2	2
Campephaga phoenicea (Latham), Black Cuckoo Shrike	3	3
Dicrurus adsimilis (Bechstein), Drongo	3	3
D. ludwigii (Smith), Square-tailed Drongo	0	1
Emberiza flaviventris Stephens, Golden-breasted Bunting	4	4
Amandava subflava (Vieillot), Zebra Wax-bill	1	1
Clytospiza monteiri (Hartlaub), Brown Twinspot	7	10
Cryptospiza jacksoni Sharpe, Dusky Crimson-wing	2	2
C. salvadorii Reichenow, Abyssinian Crimson-wing	12	14
C. shelleyi Sharpe, Shelley's Crimson-wing	1	1
Estrilda astrild (L.), Wax-bill	17	17
E. bengala (L.), Red-cheeked Cordon-bleu	23	24
E. erythronotos (Vieillot), Black-cheeked Wax-bill	1	1
E. ianthinogaster (L.), Purple Grenadier	5	6
E. melanotis (Temminck), Yellow-bellied Wax-bill	9	9
E. nonnula Hartlaub, Black-crowned Wax-bill	1	3
E. paludicola Heuglin, Fawn-breasted Wax-bill	8	14
E. rhodopyga Sundevall, Crimson-rumped Wax-bill	8	8
E. troglodytes (Lichtenstein), Black-rumped Wax-bill	1	1
Hypargos niveoguttatus (Peters), Peters' Twinspot	0	1

	1968/9	Grand Total
Lagonosticta rubricata (Lichtenstein), African Firefinch	1	2
L. rufopicta (Fraser), Brown Firefinch	5	5
L. senegala (L.), Red-billed Firefinch	69	76
Lonchura bicolor (Fraser), Black & White Mannikin	0	1
L. cucullata (Swainson), Bronze Mannikin	75	75
Nigrita canicapilla (Strickland), Grey-headed Negro-Finch	2	4
Pytelia melba (L.), Green-winged Ptylia	13	16
Spermophaga ruficapilla (Shelley), Red-headed Blue-bill	9	23
Vidua chalybeata (Müller), Indigo Bird	2	2
V. macroura (Pallas), Pin-tailed Whydah	17	27
Serinus atrogularis (A. Smith), Yellow-rumped Seed-eater	31	31
S. burtoni (Gray), Thick-billed Seed-eater	2	3
S. citrinelloides Rüppell, African Citril	5	5
S. dorsostriatus (Reichenow), White-bellied Canary	26	26
S. mozambicus (Müller), Yellow-fronted Canary	43	46
S. striolatus (Rüppell), Streaky Seed-eater	15	16
S. sulphuratus (L.), Brimstone Canary	13	13
Delichon urbica (L.), House Martin	16	17
Hirundo abyssinica Guérin, Striped Swallow	152	152
H. angolensis Bocage, Angola Swallow	42	46
H. daurica L., Red-rumped Swallow	71	72
H. fuligula Lichtenstein, African Rock Martin	1	1
H. rustica L., Swallow	1064	1845
H. semirufa Sundevall, Rufous-chested Swallow	4	4
H. senegalensis L., Mosque Swallow	1	1
H. smithii Leach, Wire-tailed Swallow	80	80
Psalidoprocne albiceps Sclater, White-headed Rough-wing	11	11
P. pristoptera (Rüppell), Black Rough-wing	13	13
Riparia cincta (Boddaert), Banded Martin	11	11
R. paludicola (Vieillot), African Sand Martin	507	509
R. riparia (L.), Sand Martin	175	929
Eurocephalus anguitimens Smith, White-crowned Shrike	1	1
Dryoscopus cubla (Shaw), Black-backed Puff-back Shrike	0	3
D. gambensis (Lichtenstein), Puff-back Shrike	4	4
Laniarius barbarus (L.), Black-headed Gonelek	18	18
L. ferrugineus (Gmelin), Tropical Boubou	6	13
L. funebris (Hartlaub), Slate-coloured Boubou	1	1
L. luehderi Reichenow, Lühder's Bush Shrike	2	2
Lanius collaris L., Fiscal	15	15
L. collurio L., Red-backed Shrike	10	82
L. excubitorius Prévost & Des Murs, Grey-backed Fiscal	6	6
L. minor Gmelin, Lesser Grey Shrike	0	2
Prionops plumata (Shaw), Curly-crested Helmet Shrike	3	3
Tchagra australis (Smith), Brown-headed Bush-Shrike	20	20
T. minuta (Hartlaub), Black-cap Bush-Shrike	6	6
T. senegala (L.), Black-headed Bush-Shrike	6	6
Malaconotus dohertyi (Rothschild), Doherty's Bush-Shrike	2	2
M. sulfureopectus (Lesson), Sulphur-breasted Bush-Shrike	4	4
Nilaus afer (Latham), Northern Brubru	1	1
Anthus cervinus (Pallas), Red-throated Pipit	9	23
A. leucophrys Vieillot, Plain-backed Pipit	2	2
A. novaeseelandiae Gmelin, Richard's Pipit	2	2
A. trivialis (L.), Tree Pipit	37	117
Macronyx croceus (Vieillot), Yellow-throated Longclaw	7	7
Motacilla alba alba L., White Wagtail	2	2
M. alba vidua (Sundevall), African Pied Wagtail	51	60
M. capensis L., Cape Wagtail	1	1
M. cinerea Tunstall, Grey Wagtail	0	1
M. flava L., Yellow Wagtail	10861	18482
Batis capensis (L.), Puff-back Flycatcher	0	2
B. minor Erlanger, Black-headed Puff-back Flycatcher	5	5
B. molitor (Halin & Küster), Chin-spot Puff-back Flycatcher	5	5
Bradornis pallidus (Müller), Pale Flycatcher	1	1
Melaenornis chocolatina (Rüppell), White-eyed Slaty Flycatcher	4	8
M. edoloides (Swainson), Black Flycatcher	10	10

	1968/9	Grand Total
Muscicapa adusta (Boie), Dusky Flycatcher	2	2
M. aquatica Heuglin, Swamp Flycatcher	4	4
M. caerulescens (Hartlaub), Ashy Flycatcher	1	3
M. striata (Pallas), Spotted Flycatcher	11	14
Myioparus plumbeus (Hartlaub), Grey Tit Flycatcher	3	3
Platysteira blissetti (Sharpe), Jameson's Wattle-eye	8	28
P. castenea (Fraser), Chestnut Wattle-eye	0	10
P. cyanea (Müller), Wattle-eye	9	10
P. peltata Sundevall, Black-throated Wattle-eye	4	12
Terpsiphone rufiventer (Swainson), Black-headed Paradise Flycatcher	2	3
T. viridis (Müller), Paradise Flycatcher	8	13
Trochocercus albonotatus Sharpe, White-tailed Crested Flycatcher	2	5
T. longicauda (Swainson), Blue Flycatcher	1	1
T. nigromitratus (Reichenow), Dusky-crested Flycatcher	5	18
Acrocephalus arundinaceus (L.), Great Reed Warbler	5	25
A. boeticatus (Vieillot), African Reed Warbler	0	1
A. gracilirostris (Hartlaub), Lesser Swamp Warbler	4	4
A. palustris (Bechstein), Marsh Warbler	1	9
A. rufescens (Sharpe & Bouvier), Greater Swamp Warbler	6	6
A. schoenabaenus (L.), Sedge Warbler	54	265
A. scirpaceus (Hermann), Reed Warbler	26	315
Apalis cinerea (Sharpe), Grey Apalis	1	1
A. flavida (Strickland), Black-breasted Apalis	1	1
A. pulchra Sharpe, Black-collared Apallis	4	6
Bathmocercus cerviniventris (Sharpe), Black-faced Rufous Warbler	7	30
Bradypterus cinnamomeus (Rüppell), Cinnamon Bracken Warbler	4	4
Camaroptera brachyura (Vieillot), Grey-backed Camaroptera	55	58
C. chloronota Reichenow, Olive-green Camaroptera	7	30
Chloropeta natalensis Smith, Yellow Flycatcher Warbler	0	1
C. similis Richmond, Mountain Yellow Flycatcher Warbler	4	4
Cisticola brunnescens Heuglin, Pectoral-patch Cisticola	1	1
C. carruthersi O. Grant, Carruther's Cisticola	4	4
C. chiniana (A. Smith), Rattling Cisticola	1	1
C. erythrops Hartlaub, Red-faced Cisticola	5	8
C. galactotes (Temminck), Winding Cisticola	31	31
C. hunteri Shelley, Hunter's Cisticola	0	1
C. natalensis (Smith), Croaking Cisticola	8	8
C. robusta (Rüppell), Stout Cisticola	14	14
C. woosnami O. Grant, Trilling Cisticola	3	3
Eminia lepida Hartlaub, Grey-capped Warbler	20	21
Eremomela icteropygialis (Lafresnaye), Yellow-bellied Eremomela	1	1
Hippolais icterina (Vieillot), Icterine Warbler	2	2
H. languida (Hemprich & Ehrenberg), Upcher's Warbler	0	2
H. pallida (Hemprich & Ehrenberg), Olivaceous Warbler	7	20
Hylia prasina (Cassin), Green Hylia	0	5
Phylloscopus budongoensis (Seth Smith), Uganda Woodland Warbler	1	1
P. trochilus (L.), Willow Warbler	140	327
P. umbrovirens (Rüppell), Brown Woodland Warbler	1	5
Prinia bairdii (Cassin), Banded Prinia	6	13
P. leucopogon (Cabanis), White-chinned Prinia	2	2
P. subflava (Gmelin), Tawny-flanked Prinia	19	22
Sylvia atricapilla (L.), Blackcap	23	49
S. borin (Boddaert), Garden Warbler	149	544
S. communis Latham, Whitethroat	2	11
S. nisoria (Bechstein), Barred Warbler	1	7
Sylvietta brachyura Lafresnaye, Crombec	3	3
S. leucophrys Sharpe, White-browed Crombec	2	2
S. whytii Shelley, Red-faced Crombec	3	3
Alcippe abyssinica (Rüppell), Abyssinian Hill Babbler	8	11
Trichastoma albipecta (Reichenow), Scaly-breasted Illadopsis	2	23
T. fulvescens (Cassin), Brown Illadopsis	3	10
T. pyrrhoptera (Reichenow & Neumann), Mountain Illadopsis	2	3
T. rufipennis (Sharpe), Pale-breasted Illadopsis	3	16
Turdoides jardinei (Smith), Arrow-marked Babbler	1	1
T. melanops (Hartlaub), Black-lored Babbler	2	2

	1968/9	Grand Total
T. plebejus (Kretzchmar), Brown Babbler	25	25
Alethe archeri (Sharpe), Archer's Robin Chat	1	1
A. poliocephala (Bonaparte), Brown-chested Alethe	10	39
A. poliophrys Sharpe, Red-throated Alethe	1	1
Cercotrichas hartlaubi (Reichenow), Brown-backed Scrub Robin	2	3
C. leucophrys (Vieillot), Red-backed Scrub Robin	20	20
C. quadrivirgata (Reichenow), Eastern Bearded Scrub Robin	0	5
Cossypha caffra (L.), Robin Chat	9	15
C. cyanocampter (Bonaparte), Blue-shouldered Robin Chat	5	12
C. heuglini Hartlaub, White-browed Robin Chat	42	48
C. natalensis Smith, Red-capped Robin Chat	0	37
C. niveicapilla (Lafresnaye), Snowy-headed Robin Chat	8	10
C. poliopte ♀ Reichenow, Grey-winged Robin Chat	0	1
Luscinia luscinia (L.), Sprosser	0	4
L. megarhynchos Brehm, Nightingale	2	6
Monticola saxatillis (L.), Rock Thrush	3	10
Myrmecocichla nigra (Vieillot), Sooty Chat	1	1
Neocossyphus poensis (Strickland), White-tailed Ant Thrush	2	3
Oenanthe isabellina (Temminck & Langier), Isabeline Wheatear	2	3
O. oenanthe (L.), Wheatear	6	16
O. pleschanka Lepechin, Pied Wheatear	2	2
Phoenicurus phoenicurus (L.), Redstart	13	18
Pogonocichla stellata (Vieillot), White-starred Bush Robin	12	24
Saxicola rubetra (L.), Whinchat	11	47
S. torquata (L.), Stonechat	2	2
Sheppardia aequatorialis (Jackson), Equatorial Akalat	8	37
Turdus abyssinicus (L.), Olive Trush	12	27
T. pelios Bonaparte, African Thrush	5	6
T. piaggiae Bouvier, Abyssinian Ground Thrush	0	6
Anthreptes collaris (Vieillot), Collared Sunbird	3	1
Nectarinia alinae (Jackson), Blue-headed Sunbird	7	7
N. bifasciata (Shaw), Little Purple-banded Sunbird	13	13
N. cuprea (Shaw), Copper Sunbird	64	65
N. erythroceria Hartlaub, Red-chested Sunbird	81	81
N. kilimensis Shelley, Bronze Sunbird	11	12
N. mariquensis (Smith), Mariqua Sunbird	57	59
N. mediocris (Shelley), Eastern Double-collared Sunbird	26	28
N. olivacea (Smith), Olive Sunbird	7	33
N. preussi (Reichenow), Northern Double-collared Sunbird	13	13
N. pulchella (L.), Beautiful Sunbird	26	26
N. regia (Reichenow), Regal Sunbird	2	2
N. reichenowi (Fischer), Golden-winged Sunbird	0	1
N. senegalensis (L.), Scarlet-chested Sunbird	54	57
N. tacazza (Stanley), Tacazze Sunbird	13	13
N. venusta (Shaw & Hodder), Variable Sunbird	8	8
N. verticalis (L.), Green-headed Sunbird	14	15
Oriolus larvatus Lichtenstein, Black-headed Oriole	1	1
O. oriolus (L.), Golden Oriole	3	4
Parus albiventris Shelley, White-bellied Tit	2	2
Amblyospiza albifrons (Vigors), Grosbeak Weaver	1	1
Anomalospiza imberbis (Cabanis), Parasitic Weaver	8	8
Euplectes albonotatus (Cassin), White-winged Widow Bird	14	14
E. ardens (Boddaert), Red-collared Widow Bird	10	11
E. axillaris (Smith), Fan-tailed Widow Bird	50	50
E. gierowii Cabanis, Black Bishop	17	17
E. hordeaceus (L.), Black-winged Red Bishop	15	15
E. jacksoni Sharpe, Jackson's Widow Bird	3	3
E. macrourus (Gmelin), Yellow-mantled Widow Bird	3	3
E. orix (L.), Red Bishop	3	3
Malimbus rubriceps (Sundevall), Red-headed Weaver	1	1
Passer eminibey (Hartlaub), Chestnut Sparrow	6	6
P. griseus (Vieillot), Grey-headed Sparrow	59	64
P. iagoensis (Gould), Kenya Rufous Sparrow	2	2
Plocepasser mahali Smith, Stripe-breasted Sparrow Weaver	2	2
Ploceus alienus (Sharpe), Strange Weaver	2	2

	1968/9	Grand Total
P. baglafecht (Daudin), Emin's & Reichenow's Weavers	50	75
P. bicolor Vieillot, Dark-backed Weaver	0	1
P. bojeri (Cabanis), Golden Palm Weaver	1	1
P. castanops Shelley, Northern Brown-throated Weaver	4	4
P. cucullatus (Müller), Black-headed Weaver	178	178
P. intermedius Rüppell, Masked Weaver	77	77
P. jacksoni Shelley, Golden-backed Weaver	90	90
P. luteolus (Lichtenstein), Little Weaver	2	2
P. melanocephalus (L.), Yellow-backed Weaver	395	425
P. melanogaster Shelley, Black-billed Weaver	1	5
P. nigricollis (Vieillot), Black-necked Weaver	3	3
P. ocularis Smith, Spectacled Weaver	44	47
P. pelzelni (Hartlaub), Slender-billed Weaver	101	101
P. superciliosus (Shelley), Compact Weaver	3	3
P. velatus Vieillot, Vitelline Masked Weaver	5	5
P. xanthops (Hartlaub), Holub's Golden Weaver	5	7
Quelea cardinalis (Hartlaub), Cardinal Quelea	42	42
Q. erythrops (Hartlaub), Red-headed Quelea	43	49
Q. quelea (L.), Red-billed Quelea	72	73
Andropadus curvirostris Cassin, Cameroon Sombre Greenbul	5	19
A. importunus (Vieillot), Zanzibar Sombre Greenbul	7	10
A. latirostris Strickland, Yellow-whiskered Greenbul	115	322
A. montanus Reichenow, Shelley's Greenbul	3	7
A. tephrolaemus (Grey), Olive-breasted Mountain Greenbul	4	19
A. virens Cassin, Little Greenbul	2	24
Bleda syndactyla Swainson, Bristle Bill	6	13
Chlorocichla flavicollis Swainson, Yellow-throated Leaf-Love	17	17
C. flaviventris (Smith), Yellow-bellied Greenbul	1	5
Phyllastrephus baumanni Reichenow, Toro Olive Greenbul	2	7
P. debilis (Sclater), Smaller Yellow-streaked Greenbul	0	3
P. fischeri (Reichenow), Fischer's Greenbul	12	45
P. strepitans (Reichenow), Northern Brownbul	5	7
P. terrestris Swainson, Brownbul	0	7
Pycnonotus barbatus (Desfontaines), Dark-capped Bulbul	379	420
Buphagus erythorhynchus (Stanley), Red-billed Oxpecker	2	2
Cinnyricinclus leucogaster (Boddaert), Violet-backed Starling	30	33
Creatophora cinerea (Menschen), Wattled Starling	5	5
Lamprotornis chloropterus Swainson, Lesser Blue-eared Glossy Starling	0	2
L. caudatus (Müller), Rüppell's Long-tailed Glossy Starling	3	3
Spreo superbus (Rüppell), Superb Starling	3	3
Zosterops abyssinica flavilateralis (Reichenow), Yellow White-eye	5	11
Z. senegalensis jacksoni (Neumann), Green White-eye	12	14
Z. s. kikuyuensis (Sharpe), Kikuyu White-eye	3	5
TOTAL	19 873	33 985
TOTAL PALEARCTIC MIGRANTS	14 878	27 376
TOTAL NUMBER OF SPECIES	323	360
TOTAL PALEARCTIC SPECIES	49	57

TABLE 2

RECOVERIES AND CONTROLS OF BIRDS RINGED IN EAST AFRICA

Key to symbols and terms

Ring number :		— Where this is in italics the ring has been returned.
Age :	f.g.	— full grown, age uncertain;
	ad.	— adult, at least one year old;
	pull.	— young, not able to fly freely;
	juv.	— juvenile, able to fly freely;
	1st W.	— first winter.
Sex :	♂	— male.
	♀	— female.
Manner of recovery :	+	— shot or killed by man;
	×	— found dead or dying;

xA	— found long dead;
/?/	— manner of recovery unknown;
v	— caught or trapped and released with ring;
()	— caught or trapped alive and not released, or released but with ring removed.

Date of recovery : — Where this is unknown, the date of the reporting letter is given in brackets.

A recovery in the strict sense is a ringed bird found dead, whether by the ringer himself or reported by a member of the public; a control is a bird ringed by one ringer and retrapped by another, or a bird retrapped by the original ringer at a point more than three miles from the locality where it was first ringed.

Charadrius pecuarius Kittlitz's Sand Plover

A. 3416	f.g.	20.4.68	Lake Nakuru, Kenya. 0°20′S., 36°06′E. DJP.
	/?/	6.4.69	Lake Elmenteita, Kenya. 0°27′S., 36°15′E. 23 km SE. (Paul Kihika)

Calidris minuta Little Stint

A. 0773	f.g.	3.3.67	ake Nakuru, Kenya. JBS.
	v	1.1.69	LNaivasha, Kenya. 0°46′S., 36°20′E. 58 km SE. (GCB)

Tringa glareola Wood Sandpiper

B. 5638	ad.	12.4.69	Lake Nakuru, Kenya. EDS.
	/?/	0.9.69	*near* Mezen', Arkhangelsk' Region, **U.S.S.R.** 65°50′N., 44°17′E. (Ringing Centre, Moscow)

Tringa hypoleucos Common Sandpiper

A. 4997	f.g.	14.4.68	Lake Nakuru, Kenya. GCB.
	+	28.5.68	*near* Chaikovskii, Perm' Region, **U.S.S.R.** 56°46′N., 54°08′E. (Ringing Centre, Moscow)

Philomachus pugnax Ruff

B. 0617	f.g.♀	6. 5.68	Lake Nakuru, Kenya. DJP.
	/?/	0.10.68	Roberts' Camp, Lake Baringo, Kenya. 0°40′N., 36°00′E. 105 km N. (Mrs. B. Roberts).
B. 5553	ad♀	8.2.69	Lake Nakuru, Kenya. EDS.
	+	20.5.69	*near* Berdigestyakh, Gornyi District. Yakutian A.S.S.R., **U.S.S.R.** 62°07′N., 126°39′E. (Ringing Centre, Moscow)

Hirundo abyssinica Striped Swallow

J. 22240	f.g.	11.2.69	Kabete, Kenya (at roost). 1°14′S., 36°45′E. EDS.
	v	25.2.69	Kabete—flew into house, caught, then released with ring.
J. 2294?	—	20.3.69	Kabete, Kenya (at roost). EDS.
	v	17.5.69	Nairobi (St. Andrew's Church) 1°16′S., 36°48′E. 13 km SE. (Alfred Mathu). The finder did not note the final digit of the number.

Hirundo rustica Swallow

J. 19928	juv.	31.10.68	Kariobangi, Nairobi. 1°15′S., 36°53′E. GCB.
	/?/	12. 6.69	*near* Chukhloma, Kostroma Region, **U.S.S.R.** 58°44′N., 42°42′E. (Ringing Centre, Moscow)
J. 21474	juv.	1.11.68	Kariobangi Nairobi. GCB.
	+	14.10.69	Busia, **Uganda.** 0°28′N., 34°05′E. 365 km NW. (P.A.A. Malingu)
J. 25893	f.g.	12.12.69	Lake Nakuru, Kenya. PLB & JFH.
	x	19. 2.68	Nakuru Sewage Farm. (Njoroge Kiarie)

J. 25897	juv.	12.12.68	Lake Nakuru, Kenya. PLB & JFH.
	/?/	3. 5.69	*near* Tjuratam, Kzyl-orda District, Kazakh S.S.R., **U.S.S.R.** 45°40′N., 63°16′E. (Ringing Centre, Moscow)
J. 27056	ad.	28.12.68	Lake Nakuru, Kenya. PLB.
	/?/	26. 7.69	*near* Tskhaltubo, Georgian S.S.R., **U.S.S.R.** 55°08′N., 48°01′E. (Ringing Centre, Moscow)

Riparia paludicola African Sand Martin

J. 26119	ad.	26.12.68	Lake Nakuru Kenya. PLB.
	v	15. 8.69	Kipsigis Tugen Farm, near Nakuru. (David arap Towett)
J. 28230	juv.	28.6.69	Lake Nakuru, Kenya. PLB.
	v	15.8.69	as J. 26119: both these birds flew into a house and were caught together.

Riparia riparia Sand Martin

J. 7066	f.g.	16.4.67	Entebbe, Uganda. 0°05′N., 32°30′E. DJP.
	/?/	20.6.69	*near* Sorochinsk, Orenburg Region, **U.S.S.R.** 52°26′N., 53°11′E. (Ringing Centre, Moscow)

Motacilla flava Yellow Wagtail

J. 5653	ad. ♂ *lutea*	8.12.68	Kariobangi, Nairobi. GCB.
	+	23.8.69	*near* Raevskii, Bashkirian A.S.S.R., **U.S.S.R.** 54°04′N., 54°11′E. (Ringing Centre, Moscow)
J. 10171	f.g. ♀ *flava*	12.2.69	Kabete, Kenya (at roost). GCB.
	x (window)	19.2.69	Nairobi, Kenya *c.* 12 km S. (I. Wahlström)
J. 14853	ad.♂ *flava*	13.2.68	Kabete, Kenya (at roost). EDS.
	xA	0.5.69	*near* Sechenovo, Gorkii Region, **U.S.S.R.** 55°12′N., 45°54′E. (Ringing Centre, Moscow)
J. 10735	ad. ♀	23.2.69	Kariobangi, Nairobi, Kenya. GCB.
	/?/	12.8.69	*near* Narym, Parabel District, Tomsk Region, **U.S.S.R.** 58° 53′N., 81° 36′E. (Ringing Centre, Moscow)
J. 29046	ad. ♀	13.3.69	Kabete, Kenya (at roost). EDS.
	+	20.6.69	*near* Yalchiki, Chuvashian A.S.S.R., **U.S.S.R.** 55° 08′N., 48°01′E. (Ringing Centre, Moscow)
J. 18236	ad. ♀	26.4.69	Kariobangi, Nairobi, Kenya. LC.
	/?/	22.5.69	*near* Shemysheika, Penza Region, **U.S.S.R.** 52°54′N., 45°24′E (Ringing Centre, Moscow)

TABLE 3

BIRDS RETRAPPED FROM PREVIOUS SEASONS

Charadrius hiaticula	2
Calidris minuta	8
Gallinago gallinago	1
Philomachus pugnax	10
Tringa glareola	1
T. stagnatilis	2
Hirundo rustica	1
Motacilla flava	195
Acrocephalus scirpaceus	1

Except for some of the *Motacilla flava*, all the above were retrapped where ringed; some of the *M. flava* showed movements of a few kilometres between roosts, and roosts and feeding sites.

KEY TO RINGERS' INITIALS IN LIST OF RECOVERIES

GCB	G.C. & D. E. G. Backhurst	DJP.	D. J. Pearson
PLB.	P. L. & H. A. Britton	JBS.	J. B. Smart
PLB & JFH.	P. L. Britton & J. F. Harper	EDS	E. D. Steel
LC.	Mrs. L. Campbell		

OTHER RINGERS IN EAST AFRICA

Miss D. Angwin	G. Harrington
Miss J. Angwin	M. Reid
Miss E. Blundell	D. A. Turner
R. Cheke	R. Waterhouse
M. P. L. Fogden	R. J. Wheater

TABLE 4

RECOVERIES IN EAST AFRICA OF BIRDS RINGED ABROAD

This list includes some further additions to the recoveries of birds ringed abroad prior to 1 July, 1967 (Backhurst, 1969*b*.)

The signs and symbols are the same as those used in Table 2.

Ciconia ciconia		White Stork	
Zagreb			
D. 102368	pull.	15.6.55	Balimbegova, Skopje, **Yugoslavia.** 42°00'N, 21°30'E.
	/?/	18.9.56	Itobo, Nzega District, Tanzania. 4°59'S., 32°48'E.
Zagreb			
D. 106069	pull.	4. 6.62	Aradac, Zrenjanin, **Yugoslavia.** 45°25'N., 20°24'E.
	v	5.11.62	Karamoja District, Uganda. c. 0°45'N., 31°58'E.
Larus fuscus		Lesser Black-backed Gull	
Göteborg			
D. 45945	pull.	26.6.60	Spjutsö, Bräkne Hoby, Blekinge, **Sweden.** 56°08' N., 15°02'E.
	x	1.10.60	Musoma, Tanzania. 1°31'S., 33°48'E.
Stockholm			
8.009.210	pull.	5. 7.62	Låggrund, Öregrundsgrepen, Uppland, **Sweden.** c. 60°27'N., 18°18'E.
	+	24.9.62	Lake Salisbury, Soroti, Teso District, Uganda. 1°40'N., 34°00'E.
Helsinki			
H-55.916	pull.	3. 7.66	Gamlakarleby, (Vasa), **Finland.** 63°50'N., 23°06'E.
	x	22.8.68	Agwatta, Uganda. 1°59'N., 33°00'E.
Helsinki			
H-93.014	pull.	13. 7.68	Västerskär, Tjöck (Vasa), **Finland.**
	x	25.11.68	Nyamazugo, Geita District, Tanzania. 0°30'S., 32°30'E.

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(Received 21st January, 1970)

MIGRATIONS OF THE BUTTERFLIES *GLYCESTHIA AUROTA, CATOPSILIA FLORELLA* AND *CRENIS OCCIDENTALUM* IN EAST AFRICA IN 1967-68

By

JOHN E. C. FLUX

Zoology Department, University College, Nairobi and
Ecology Division, D.S.I.R., New Zealand

The complex patterns of insect migration in Africa are not well understood for even the two commonest pierid migrants *Glycesthia aurota* Fab. and *Catopsilia florella* L. For a review of existing records and illustrations of these two species see Williams (1958), and for the most recent discussion of the problems involved, Johnson (1969). From July, 1967 to July, 1968 all butterflies which appeared to be migrating (most fly below 20 ft. and are very conspicuous) were counted for five minutes (Table 1) as they crossed an open area 50 yards wide in front of my office at the Botany Department, University College, Nairobi. Field trips away from Nairobi generally took less than one week and, as major migrations usually take longer than this, probably few were missed during the year. No attempt was made to select days or times of day of special abundance for the counts, which were made whenever butterflies were sufficiently numerous to be noticed. Wind direction varied and did not seem to affect orientation at all, but most movement occurred in sunshine. The butterflies were identified from collections in the National Museum, Nairobi.

ACCOUNTS OF SPECIES

Glycesthia aurota

There was a strong easterly migration from 17 July to 4 August, 1967 or a little later (I was absent from 5-15 August and migration had ended on my return). Species actively migrating in the same direction included many *G. creona* Cramer and *Precis* sp., but several other species seemed to get caught up in this movement occasionally. The average intensity was 64 *G. aurota* per five minutes across the 50-yard front, and at least the whole of Nairobi (four miles wide) was affected.

From mid August till the end of the year few *G. aurota* were seen, although there was a weak westward migration averaging 15 butterflies per five minutes from 9 to 17 December, 1967 after the short rains.

A major movement started on 30 January, 1968 and reached a peak on 3-5 February when over 400 butterflies were passing each five minutes. On 5 February, 1968 I drove from Nairobi to the north side of Mt. Kenya and saw vast numbers of *G. aurota* moving west over the whole route. Mr. A. Walker told me they were just as abundant and moving in the same direction, for at least 20 miles down the Nairobi-Mombasa road. This gives a north-south front of 110 miles, and assuming a six-hour day (most activity was between 1000 hrs and 1600 hrs), a total of 111 million butterflies per day. A few *G. aurota* were moving west over alpine moorland at 13,000 ft. on the north side of Mt. Kenya, and eight dead ones (six male and two female) were picked up which had presumably been killed by frost at night. The movement had almost ended by 9 February when I returned to Nairobi.

In the second half of March 1968, there was a small migration to the east or east north-east, but no others before I left Nairobi on 31 July, 1968.

TABLE I

FIVE MINUTE COUNTS OF BUTTERFLIES CROSSING TO RIGHT OR LEFT OVER A 50 YARD LINE OF SIGHT AT RIGHT ANGLES TO THE DIRECTION OF MOVEMENT, AT CHIROMO, NAIROBI

Date	*No. Butterflies and direction*		*Remarks*
Glycesthia aurota			
17. 7.67	79 flying E	3 flying W	Several other species also
18. 7.67	56 ,, ,,	1 ,, ,,	
28. 7.67	30 ,, ,,	1 ,, ,,	
31. 7.67	66 ,, ,,	2 ,, ,,	
1. 8.67	60 ,, ,,	2 ,, ,,	Very few for next month
4. 9.67	9 ,, ,,	1 ,, ,,	Very few for next 3 months
9.12.67	2 ,, ,,	16 ,, ,,	
12.12.67	1 ,, ,,	4 ,, ,,	
17.12.67	6 ,, ,,	14 ,, ,,	Several other species
30. 1.68	2 ,, ,,	111 ,, ,,	New emergence. None all January
31. 1.68	0 ,, ,,	2 ,, ,,	
1. 2.68	2 ,, ,,	26 ,, ,,	
2. 2.68	1 ,, ,,	142 ,, ,,	
3. 2.68	2 ,, ,,	362 ,, ,,	
4. 2.68	5 ,, ,,	493 ,, ,,	
13. 2.68	9 flying SSE	7 flying W	Direction rather confused
18. 2.68	7 ,, S	46 ,, ,,	
16. 3.68	23 ,, ENE	2 ,, ,,	New emergence over past few days
26. 3.68	15 ,, E	1 ,, ,,	Includes 2 *Precis*
27. 3.68	13 ,, ,,	0 ,, ,,	
31. 3.68	32 ,, ,,	0 ,, ,,	Includes 1 *precis*. Few for next 4 months
Catopsilia florella			
3. 1.68	13 flying NE	2 flying SW	
6. 1.68	10 ,, ,,	1 ,, ,,	
14. 1.68	19 ,, ,,	0 ,, ,,	
15. 1.68	17 ,, ,,	0 ,, ,,	
16. 1.68	24 ,, ,,	2 ,, ,,	
17. 1.68	16 ,, ,,	2 ,, ,,	
30. 1.68	2 ,, ,,	0 ,, ,,	
31. 1.68	21 ,, ,,	0 ,, ,,	
1. 2.68	1 ,, ,,	0 ,, ,,	
2. 2.68	3 ,, ,,	0 ,, ,,	

Catopsilia florella

Only one migration of this species occurred during the year, from 3 January to 2 February, 1968, averaging 13 (max. 24) butterflies per five minutes. Two features were noted: the butterflies preferred to fly up and over the three storey building across their path rather than detour round it; and from 30 January to 2 February their north-easterly path crossed the far stronger westerly one of *G. aurota*. This provided the fascinating spectacle of completely independent streams of insects flying in different directions, as described by Williams (1958) for *C. florella* and *Terias senegalensis* Boisd.

Crenis occidentalum Mabille (Nymphalidae)

On 30 June, 1968 from 40 miles north to seven miles west of Fort Portal, Uganda, *C. occidentalum* was flying south-east against a moderate wind. The butterflies kept within five feet of the ground and at their thickest 205 were counted in five minutes crossing a 50 yard space in front of the car. Since we drove from Hoima to Queen Elizabeth Park this day, the approximate width of the migration (40 miles) was known, but not its duration. Three female and four male butterflies were picked off the car radiator, so both sexes were involved.

ACKNOWLEDGEMENTS

I am grateful for the New Zealand National Research Fellowship which enabled me to work in East Africa; to Professor D. S. Kettle for providing facilities; and to Drs. M. C. Crawley and J. A. Gibb for commenting on the manuscript.

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(Received 17th February, 1969)

OBSERVATIONS ON BUTTERFLY MIGRATION AT ENTEBBE, UGANDA

By

S. D. K. Sempala

(East African virus Research Institute, Entebbe Uganda)

INTRODUCTION

Bird migration has been recognized as a to-and-fro movement for a long time, but this type of movement is recorded for relatively few species of butterflies. The best known of these are the Monarch (*Danaus plexippus* L.) of North America and the Red Admiral (*Vanessa atalanta* L.) and Painted Lady (*V. cardui* L.) of the Old World.

Records of migratory movements in these and many others, amounting to a total of 214 species, are summarized by Williams (1930) who defines insect migration as follows:

"It is a periodic, more or less unidirectional continued movement assisted by the efforts of the animal and in a direction over which it exerts a control, which results in the animal passing away from its previous daily field of activity."

It should be noted that Williams' definition does not state that migration is necessarily a two-way movement, although he also discusses the importance of observations on return flights which, in contrast to gregarious outgoing flights, are often very thinly spread and therefore likely to be overlooked.

The butterfly movements reported below at Entebbe were largely unidirectional, the insects flying consistently against the wind. They represent examples of trans-migration. (Williams, *ibid.*)

OBSERVATIONS

Sites: All observations were made in the area of Entebbe town and its surroundings within a distance of five to ten miles north of the equator.
Period of observations: Observations during the time of migration were conducted from the beginning of June to the end of the first week of July, 1967. Daily casual observations were made up to the end of the year and throughout 1968.*

The detailed counts were all made on the compound of the East African Virus Research Institute on an extensive open area of mown lawn. Other occasional observations were made on the golf course, the airstrip, Kigungu beach which faces south into the open lake and on the lake about three hundred yards from the shore at Kigungu.
Methods: At the principal site a front of 35 yards running East-West was established, and insects flying across this line were counted and their direction noted. This front lay more or less at right angles to the main direction of flight.

RESULTS

Species represented:

Specimens were taken of the following migrating species:—
Belenois creona Cr. (Pieridae)
Catopsilia florella Fab. (Pieridae)
Papilio demodocus Esper (Papilionidae)

*No further migration has been apparent at Entebbe up to July 1970.

FIGURES 1 – 3 Show the relative intensities and direction of migration of B. creona, C. florella and Papilio spp. respectively. The scales are different. The time during which counting was done totalled 270 minutes spread out during the entire course of observation.

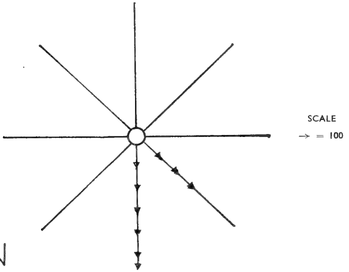

FIG. 1 Belenois creona

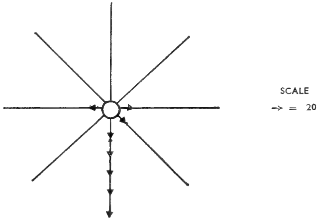

FIG. 2 Catopsilia florella

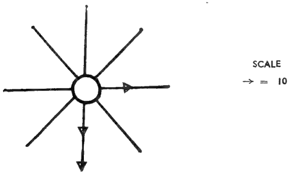

FIG. 3 Papilio spp.

Records of these and of the conspicuous *Papilio bromius/nireus* group were made. Towards the end of June and in early July some large yellow Pierids were evidently migrating, but as these flew high and evaded identification, records are not given.

B. creona was by far the commonest migrant. It is possible that closely similar *Belenois* species may have been represented, but out of a total of 70 specimens collected over six occasions with at least one sample per week through June (apart from the third week when overall numbers were very low), all were of the single species *B. creona*. Well over 50 per cent observed were males.

C. florella was also fairly common, particularly towards the end of the period of observations. Other species recorded were relatively scarce, though definitely on the move.

Resident species of *Eurema*, *Neptis*, small Lycaenids and others, though quite commonly seen, showed no consistently directional flight. Other butterflies could have been migrating elsewhere on the Entebbe peninsula, but none was seen at the sites used for regular observations.

Migratory movements:

Overall period: Considerable migration of butterflies had been in progress at Entebbe for at least two weeks before detailed observations began. Figures 1, 2 and 3 do not therefore represent the full period of migration, but they do show the relative intensity of migration during the period of the observations. There was no butterfly migration across Entebbe peninsula during the extended period of observation.

Time of day of flight: In order to obtain an indication of the period of commencement, peak and cessation of flight activity, counts lasting for five minutes each were conducted every hour throughout the day (on 14 June) which was calm and sunny. The results are given in the table.

TABLE

RESULTS OF A 5-MINUTE COUNT IN EACH HOUR THROUGHOUT THE DAY ON THE 14th JUNE (ON A 35-yd FRONT)

TIME (Solar time)	BUTTERFLY SPECIES			TOTAL
	BELENOIS CREONA	*CATOPSILIA FLORELLA*	*PAPILIO* SPP.	
0700—0705	0	0	0	0
0800—0805	0	0	0	0
0900—0905	0	0	0	0
1000—1005	9	0	0	9
1100—1105	13	2	2	17
1200—1205	17	4	1	22
1300—1305	67	3	1	71
1400—1405	128	0	0	128
1500—1505	63	0	0	63
1600—1605	12	0	0	12
1700—1705	1	0	0	1
1800—1805	0	0	0	0
TOTAL ..	310	9	4	323

The difference in the periods of peak activity in the species under consideration are hardly significant, as the number of *C. florella* and *Papilio* spp. were too small. The results nevertheless demonstrate that flight activity was distinctly diurnal leading up to, and from, midday to early afternoon (solar time) maximum in *B. creona*.

DISCUSSION

It is noteworthy that all species of migrating butterflies observed showed a marked southerly bias in flight direction which would have taken them out into the open lake. However, the method of choosing a front which lies more or less at right angles to the main direction of flight, and then counting butterflies flying across this line is likely to yield quantitatively biased results. This was not realized at the time and the results given here should be viewed accordingly. When movement is entirely unidirectional it would seem obvious that to assess flight activity one would follow the above method. On the other hand, for insects which diverge from the main directional axis, the real front is reduced as their direction of flight approaches that of the front. Thus, if one considers insects flying at random across an East-West line, then none of those flying due East or West would be recorded at all, and the resultant directional chart would be shaped like a figure-of-eight. To eliminate such bias it is suggested that an area should be staked which subtends 60° of a circle. The observer should stand at the centre of the circle, and insects counted and their direction noted at the points at which they enter the area. Such a method would be feasible when conspicuous butterflies are under observation. The radius of the area may be varied depending on observability.

If the tendency to migrate southwards is genetically determined, then one might assume that migration must be of considerable advantage to persist in such a spectacular form as indicated by the numbers observed. These butterflies were migrating not only at Entebbe during this period; on 27 and 28 May *Belenois* butterflies were seen in very great numbers flying across the Kampala to Mbarara road, a distance of 165 miles, in a south and south-eastwards direction (J. Kingdon, *pers. comm.*) and the same movement was observed on 3 June and it was estimated that more than 95 per cent were flying towards the lake (A. W. R. McCrae, *pers. comm.*) By 11 June numbers appeared to be much fewer and direction less consistent (*idem*).

The observation that flight activity was distinctly diurnal with a midday to early afternoon maximum in *B. creona* raises the question of whether the butterflies would rest or attempt to rest while over the lake. There are numerous examples of butterflies and other insects being seen at great distances out to sea. R. H. Carcasson (pers. comm.) has personally seen swarms of *V. cardui* in the Mediterranean and *C. florella* in the Arabian sea, some five hundred miles from the nearest land. This suggests either that they are capable of resting on and taking off from the sea* or that over open water they do not cease flying. This may be a question of assistance by winds and by endurance in terms of energy reserves. Hocking (1953) calculated that owing to the high efficiency of a food reserve in the form of fat, many lepidoptera are capable of flying several hundred miles without feeding. A proportion of the butterflies which head over the lake from Entebbe and other places may nevertheless perish before they reach land, and such migrations could be suicidal. It would be of great interest to have observations from the southern and south-eastern shores of Lake Victoria, e.g. from Mwanza.

The causes and objectives of such migrations still remain a matter for speculation. *B. creona* is a very widespread and highly mobile species inhabiting dry country, as numerous records of migratory flights show (Williams, 1930). The food plant of this species include *Capparis* and *Maerua* (Williams, 1930; R. H. Carcasson, *pers. comm.*), plants which occur in Uganda largely in dry thicket country along the Western rift and in the north-west of the country. Pitman (1928, *in* Williams, 1930) believed that these migrations originate in the lowlands of West Nile district where he remarked: "One can only describe as amazing the vast breeding grounds encountered. I have never before seen such countless myriads of butterflies, as far as the eye could see there was a

*Urquhart, in a monograph on the "Monarch Butterfly" of North America, proves by experiment that it can rest on the surface of water and also can rise from the surface when released from below the surface. Published by the Toronto University. M.C.

shimmer of white just above the surface of the ground . . . . "; he did not observe directional movements at the time. It was clear that this population was extremely crowded and food for the ensuing larvae would have been limited, therefore necessitating either very high mortality or dispersal. Food supply in such dry areas is seasonal, and such locally abundant species may only survive periods of food shortage either by a period of dormancy or by migration.

A closer study of the biology of migratory *Belenois* should illuminate these extremely interesting problems.

SUMMARY

Observations on migrant butterflies at Entebbe are described. *B. creona*, *C. florella*, *P. demodocus* and the *Papilio bromius/nireus* group were the species represented during the course of migration and they all showed a marked southerly bias in flight direction.

ACKNOWLEDGEMENT

The author is greatly indebted to Dr. M. C. Williams, formerly Director of the East African Virus Research Institute, Entebbe, for suggesting this study. I would also like to thank Mr. A. W. R. McCrae for his encouraging advice and assistance in preparing this manuscript and Mr. C. Mawejje for his valuable field assistance.

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(*Received 12th May, 1969*)

AN ANALYSIS OF THE FEATURES OF *SARDINELLA GIBBOSA* (BLEEKER) SCALES, WITH SPECIAL REFERENCE TO THE PROBLEM OF AGE DETERMINATION

By

W. OKERA

Department of Zoology & Marine Biology, University College, Dar es Salaam

INTRODUCTION

Five species of *Sardinella* have been recorded in East African waters (Losse, 1968), *S. gibbosa* and *S. albella* (Valenciennes) being the most common in inshore waters of the Tanzanian coast. This investigation on the scales of *S. gibbosa* was a product of an attempt to find out whether there was any possibility of reading from the scale of the age of this species of sardine from its scales.

In temperate waters where the seasons are well marked, many of the piscine structures, e.g. scales, otoliths, vertebrae, dorsal spines, pectoral spines and opercular bone, show well defined differences in their growth. The seasonal growth zones in scales and otoliths have provided a relatively easy and quick way of assessing the absolute ages of commercially important fishes such as herring, cod, plaice, and salmon with a satisfactory degree of accuracy. Beside these growth rings which are formed as a result of the accelerated and retarded growth processes during spring and winter respectively, "the scales of many fishes show spawning rings and marks which are the result of the cessation of feeding and exhaustion during the spawning period", (Nikolsky, 1963, page 194). Therefore if the fish spawns once a year and at the same time leaves a spawning ring on its scales, the number of these rings can be used to read the age of the fish since it first started spawning.

The biology of East African *S. gibbosa* and other local sardines is very poorly known. For example, it is not known at what length or at what age the local *S. gibbosa* attains sexual maturity. Its maturation and spawning habits are also not known. For the Indian *S. gibbosa*, Nair (1959) mentions that Chacko (1946) found *S. gibbosa* to attain sexual maturity in the Palk Bay and Gulf of Manar regions when it reaches a length of 14 cm. whereas Sekharan (1955; quoted from Nair's paper) "showed that the fish below 8.5 cm. are immature and a proportionate increase of mature fish was observed in the higher size groups, with most of the sardines of the 10.7 cm. size group being mature." Sekharan also concluded that maturity is attained at this size at the end of first year. Ganapati and Rao (1957; quoted from Nair's paper) working on *S. gibbosa* of Lawson's Bay, Waltair, found that the species attains maturity at an average length of 11 to 12 cm. As for the maturation and spawning habits of this species of sardine, Dharmamba (1959) showed that *S. gibbosa* of Lawson's Bay has "a single spawning season a year" and "spawning is restricted to a definite short period with individuals spawning only once in each season." Losse (unpublished data) says that, in the Zanzibar Channel, the spawning season of *S. gibbosa* extends from April to October, with the smaller fish being first spawners and spawning early in the year (April/May) and the largest spawning in August to October, after the main spawning peak of June/July. From Losse's observation, it is perhaps justifiable to say that the local *S. gibbosa* has a single spawning season a year and that generally, individuals belonging to different size groups have a restricted spawning period at different times during the spawning season. Therefore if *S. gibbosa* spawns once a year, it is worth investigating whether the annuli seen on its scales result from the spawning activity of the fish or are caused by other unknown factor/facortors.

At first it was found necessary to investigate and ascertain the nature of other conspicuous features of the scale, namely the *striae* and the fissures, so as to eliminate any possibility that they may be associated in some way with spawning.

MATERIAL AND METHOD

For all examinations, the specimens were obtained from a local, Japanese-built, sardine-fishing vessel operating the Japanese stick-held dipnet, the "*Bouk-ami*". Material for histological examination was fixed in Allen's B15 (1500 ml. saturated aqueous picric acid + 500 ml. 40 per cent formalin + 100 ml. glacial acetic acid + 40 gm. urea + 30 gm. chromic acid) immediately after the fish were caught. Fixation was allowed to take place for about twenty-four hours and the fixed material was then washed thoroughly with tap water. Pieces of the skin with a little underlying muscle were then cut—each about 2 cm. long, 3 cm. deep and 2 to 3 mm. wide—and processed as follows:—
Dehydration to 70 per cent alcohol—decalcified in a solution of 5 per cent HNO_3 in 70 per cent ethanol for 12 hours—dehydrated to 100 per cent alcohol—left overnight in 8μ methyl benzoate/celloidin solution—blocked in wax and sectioned at 8μ thickness. The sections were stained with Masson's trichrome method, using iron Haematoxylin, Xylidine ponceau—acid fuchsin mixture and light green solution.

Scales for whole mount examination were first stained with carmine and mounted with Canada Balsam, but this method proved faulty as some of the features were masked with the stain and the mounting fluid. The method was abandoned in preference to mounting the scales dry between two glass slides taped at the ends. The latter method was also proved useful for the Northern achovy, *Engraulis mordax* and the Pacific sardine *Sardinops caerulea* (Girard) (Miller, 1955).

THE SCALE

Examination of *S. gibbosa* scale (fig. 1) shows several features whose nature has received a sparse and inadequate mention in the literature:

(i) *The circuli or striae:—*

These are the very fine transverse lines that run from dorsal to ventral* sides of the scale, nearly parallel to each other. Sometimes, one or a few may end abruptly or one *stria* may fuse with another. In longitudinal section (fig. 2) the striae can be seen to form very fine ridges in the bony layer. The posterior region of the scale which is not embedded in the scale pocket lacks the surface sculpture of *striae;* instead there are a number of round or oval perforations and growth patterns unique to this region. The posterior margin of the scale is crenulate.

As to the function of these *striae*, Van Oosten (1957) says "they are probably functioning in anchoring the scale in its pocket". He makes no suggestion as to how this may be achieved. Kerr (1952) makes the following comment about the longitudinal calcified ridges of *Amia calva* L. scale: "Possibly along with anchoring strands of connective tissue from the rear of the scale, they serve to maintain the position of the scale, to allow flexibility under normal circumstances and yet to permit the tearing out of a scale by a predator without excessive damage to the skin. Such a general explanation might apply also to the concentric striations of the teleost scale . . . . " In the light of modern studies on the reflectivity in silvery teleosts (Denton & Nicol, 1966) one may also postulate that the *striae* may play a part in the visibility of the fish. For instance, it would be relevant to investigate the light transmitting properties of the striated and non-striated parts of the scale, and also the relationship of the reflecting layers (stratum argenteum and layers of

* The lateral sides of the scale are referred to as the dorsal and ventral with respect to the scale's orientation on the body of the fish.

orientated reflecting platelets) to the two distinct regions of the scale. All these suggestions need to be subjected to the rigours of experiments, before the functions of the *striae* can be fully understood.

(ii) *The posterior continuous fissure and the dorsal and ventral fissures:—*

These fissures, the dorsals, ventrals, and the posterior are represented by thick lines in fig. 1, and labelled dvf and pf in fig. 2. No work to my knowledge exists on the nature and formation of these fissures. Photographs of the scale of *Caspialosa kessleri* Grimm, (in Nikolasky's *The Ecology of Fishes*, 1963, page 194) and *Engraulis mordax*, (in Miller's 1955 paper) show structures which appear to be similar but not identical to the fissures under consideration; no mention of these structures is made in the text.

Eighty scales from twenty-five individuals of *S. gibbosa* were removed from the lateral body wall, in the region behind the dorsal fin, about 1/3 to 1/2 from the dorsal profile of the body. All of them showed one general pattern; a posterior continuous fissure and several dorsal and ventral fissures (fig. 1). Often, the scales have an equal number of the dorsal and ventral fissures which are symmetrically arranged. For example, of the 80 scales examined, 43 had an equal number of the dorsal and ventral fissures and the remaining 37 had an unequal number of dorsal—ventral fissures. In another fish, 43 scales were removed from a single scale row (hatched line, fig. 5), beginning with the scale behind the humeral spot and ending with the one preceding the

Table 1, showing the number of dorsal and ventral fissures of 43 scales removed from a single scale row, (hatched line, fig. 5)

Scale	Number of fissures Dorsal-Ventral	Length of scale row occupied by consecutive five scales. All distances measured from humeral spot.	Scale	Number of fissures Dorsal-Ventral	Length of scale row occupied by consecutive five scales. All distances measured from humeral spot.
1	2—2		21	5—5	
2	1—1		22	6—5	
3	3—3	0—1cm	23	5—4	4.85-6.2cm
4	5—3		24	6—4	
5	4—3		25	6—5	
6	3—4		26	5—5	
7	3—3		27	6—5	
8	4—3	1—2.2cm	28	6—5	6.2-7.4cm
9	4—3		29	7—6	
10	5—3		30	7—5	
11	4—3		31	7—5	
12	5—3		32	7—6	
13	4—3	2.2-3.65cm	33	5—5	7.4-8.5cm
14	5—3		34	5—5	
15	4—4		35	5—6	
16	5—5		36	6—4	
17	4—4		37	6—6	
18	3—5	3.65-4.85cm	38	5—4	8.5-9.75cm
19	6—4		39	7—7	
20	6—4		40	6—4	
			41	5—5	
			42	5—3	9.75-10.55cm
			43	4—4	

TABLE 2

Number of annuli	Length of fish in mm
0	117(1), 118(1), 119(1), 123(1), 125(2), 126(3), 127(1), 128(1), and 131(1).
1	118(1), 122(1)

Table 3 gives the result of annulus reading of samples of fish taken during the months of January, March, April, and May, 1969. For convenience, the individual lengths of fish have been omitted and instead the fish have been put into 5mm size groups.

irregular scales of the caudal peduncle. Again all of them showed the basic pattern—a posterior continuous fissure and several dorsal and ventral fissures. Of the 43 scales, 15 had an equal number of the dorsal—ventral fissures, while the remaining 28 had an unequal number of dorsal—ventral fissures, there being not more than 2 extra fissures on either the dorsal or ventral side of the scale (see Table 1). Scales from the caudal peduncle, from the region immediately behind the opercle and from the dorsal profile showed an irregular pattern of these fissures.

After examination of all these scales, it became apparent that these fissures had nothing to do with spawning, simply because spawning marks are left as circular scars rather than transverse marks. Further, longitudinal sections of the scale (fig. 2) revealed that the fissures were filled with a connective tissue material that was staining green, just like the walls of the scale pocket, suggesting that the fissures were probably passages for strands of connective tissue that helped to hold the scale in its pocket. Perhaps they also serve to increase the scale's flexibility.

An explanation as to how these fissures may be formed was sought by studying the scale in relation to its surrounding features. The imbrication of the scales (fig. 3, 4) seemed to be a possible cause for the fissures. Fig. 4 shows the pattern of the anterior edges of the scale pockets, and it is from these anterior edges that the dorsal walls of the scale pockets emerge from the body wall. Considering the scale M (fig. 4), it seems that as this scale grows outwards and overlaps part of the anterior edges, l_1, l_2, r_1, r_2, (shown by thick lines in fig. 4) of the scale pockets flanking it dorsally and ventrally, connective tissue from l_1, l_2, r_1, and r_2, grows through scale M which overlies l_1, l_2, r_1, and r_2. This explanation is based on the observation that the only structure on the body wall that can be likened with the form (i.e. orientation, thickness and length) of the dorsal and ventral fissures are the overlain portions of the anterior edges of the scale pockets. (see fig. 4).

However, there are several difficulties involved in this hypothesis. Firstly, a scale usually overlies the portions of anterior edges of *two* pockets on its dorsal and ventral sides, whereas the number of dorsal and ventral fissures found on a scale varies from two to eight on either side. That is, a scale may have two dorsals and two ventrals or four dorsals and five ventrals or eight dorsals and six ventrals and so on.

Secondly, although the formation of dorsal and ventral fissures may be explained by considering the bordering scale pockets, the formation of the posterior continuous fissure does not seem to be explicable on the same basis.

Thirdly, it is difficult to explain the pattern of fissures of the scale of *E. mordax* (assuming that the lines and splits seen in the photographs of *E. mordax* scales are similar to the fissures under consideration) or of the caudal peduncle scales of *S. gibbosa* by the growth—imbrication theory.

TABLE 3

MONTH AND NUMBER OF FISH EXAMINED	NUMBER OF ANNULI	SIZE GROUPS (LENGTH IN MM.)									
		86-90	91-95	96-100	101-105	106-110	111-115	116-120	121-125	126-130	131
JANUARY, 1969	0	0	6	10	1	1					
24 fish	1-doubtful	1		1		1					
	1-clear		1	1	1						
MARCH, 1969	0	1	2	2	3	4	1	0	1	4	
25 fish	1-clear							1		3	
	1-clear, 2nd doubtful								1		
	2-clear								1	1	
APRIL, 1969	0				1	4	2	6	4	2	
	1-doubtful					1		1		1	
25 fish	1-clear							1		1	
	1-clear, 2nd doubtful										1
MAY, 1969	0						4	2	2	1	
	1-doubtful									2	2
25 fish	1-clear									3	3
	1-clear, 2nd doubtful									1	
2-clear										4	
	2-doubtful									1	

Whitear (pers. comm.) points out that the fissures might correspond to the canals penetrating the scales of more primitive actinopterygians which usually carry blood capillaries and nerves. Further histochemistry is needed to ascertain the presence of these structures in the fissures of *S. gibbosa.*

Thus the problem of explaining the formation of these fissures still remains unsolved and a solution could perhaps emerge by studying the development of these scales.

Before leaving the fissures, it may be mentioned that Losse (1966, 1968) refers to these fissures as *striae,* whereas Van Oosten (1957) defines *striae* as "the relieved[1*] surface ridges that are continuous and homogenous with the bony layer of the scale". As mentioned earlier, the *striae* are the very fine and numerous transverse lines that are seen in a whole mount of the scale and in L. S. as fine ridges in the bony layer. Van Oosten (1957) does not mention the fissures[2*] although they are of importance in classification of the Clupeidae (Losse, 1966, 1968).

(iii) *Annuli*

In fig. 1, these are shown by the two narrow and light coloured bands that are concentric with most of the periphery. Miller (1955) refers to these rings in *E. mordax* scales as "typical clupeoid annual checks". He uses the definition of an annulus as given for the Pacific sardine, *Sardinops caerulea* (Giaard), by Walford & Mosher (1943b) as a basis for annulus interpretation in *E. mordax.* It seems that this definition which is as follows, also applies to annulus recognition in *S. gibbosa.*

"An annulus is concentric with the margin of the scale. It is not always a sharp or unbroken line; nor are the segments of an interrupted annulus always perfectly co-circular (if the shape of a scale may be called circular in this discussion). But the course of an annulus, continuous or broken as it may be, can usually be traced, by careful scrutiny if necessary, entirely around the sculptured part of the scale from left hand to right hand margins. Sometimes they can be followed even around the unsculptured part. Annuli are clearly separated from each other and do not ordinarily meet at any point. *If an annulus has formed it is present in all the normal scales of an individual*", (quoted from Miller, 1955).

TABLE 4

Month	Percentage composition of fish in the sample with different number of annuli					
	0-annulus	1-doubtful	1-clear	1-clear 2nd doubtful	2-clear	2-doubtful
January 1969	75	12.5	12.5	0	0	0
March 1969	72	0	16	4	8	0
April 1969	76	12	8	4	0	0
May 1969	36	16	24	4	16	4

*1 = relief. His usage is not correct. Surface ridges would have been sufficient.

*2 = unless his *radii,* defined as "open channels cut completely through the bony surface", are equivalent to what I have called fissures.

It may be mentioned that the annual growth rings on scales of temperate fishes such as salmon and trout are also called annuli. The annuli in these fishes are formed by the circuli being closer together at certain times of the year than at others. De Bont (1967) mentions that Holden (1955) described the annuli of *Tilapia variabilis* Boulenger and *T. esculenta* Graham of Lake Victoria as rings which are formed by irregular circuli.

In *S. gibbosa*, the annulus is formed by the *striae* being either interrupted, indented or bent in the annular region and the spaces between the *striae* are "lighter" in the annular region compared to the rest of the striated region of the scale.

In order to find out whether the Walford and Mosher definition of an annulus also holds for *S. gibbosa* scales, three individuals of the sardine were examined in detail for annuli marks on their scales. 259 scales were removed from regions 1 to 12 (fig. 5) of a 125 mm. Standard Length (S. L.) fish, and nearly all of them had no annulus. In a second individual of 132 mm. S. L., 151 scales were removed from regions 1 to 12, and nearly 90 per cent of the scales showed a clear formation of a single annulus. In the third specimen 129 mm. S. L., 153 scales from regions 1 to 12 were examined and 70 per cent of the scales showed a clear formation of two annuli.

Fourteen other individuals (a very small part of the catch taken on the night of 26 November, 1968) were examined for annulus marks. In these cases about 12 scales only were removed from regions 5 and 8 (fig. 5) of every fish and the scales were then examined for annuli. Table 2 shows the result obtained; the figures in parentheses give the number of fish in that size group.

Table 4 gives the percentage of fish in the sample with different number of annuli for the same months viz. January, March, April and May 1969.

Table 5 has been included to show that it is also possible to read the number of annuli from *S. albella* scales. Sixteen individuals were obtained from a mixed subsample of about a thousand fish, the latter being part of the catch taken on the night of 17 February, 69.

TABLE 5

Number of annuli	Length of fish in mm.
0 1 doubtful	72(1), 91(1), 98(1), 99(3), 101(1), 102(1) 103(2). 104(1)
1 clear	105(1)
1 clear, 2nd doubtful	97(1), 129(1)
2 clear	102(1), 103(1).

Fig.1

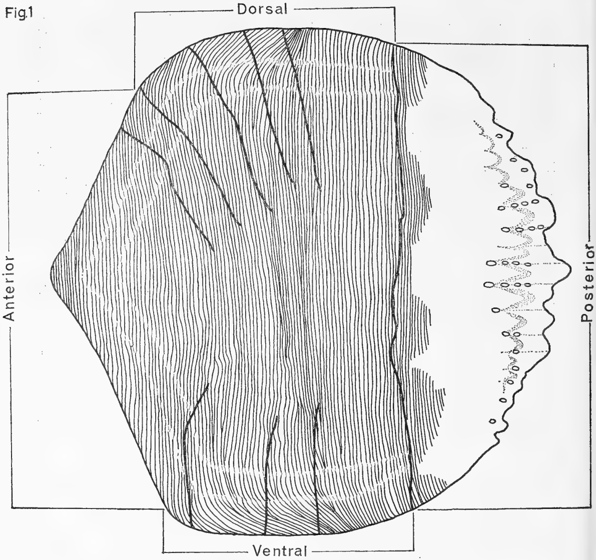

Fig. 1—Surface view of *S. gibbosa* scale. The directions indicate the orientation of the scale relative to the orientation of the fish. Fissures are shown in thick lines and the two annuli by the two light incomplete circular bands. × 30.

Fig. 2

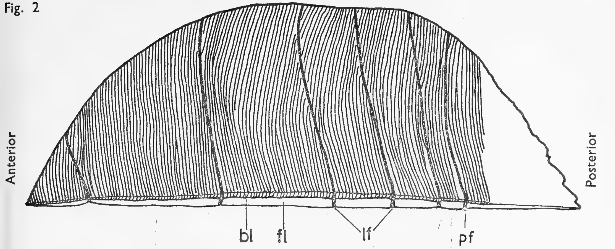

Fig. 2—Longitudinal section of *S. gibbosa* scale, showing the posterior fissure and one set of the lateral fissures. Key: pf—posterior fissure; lf—lateral fissures; bl—bony layer of the scale; fl—fibrillary layer of the scale. × 60.

Fig. 3

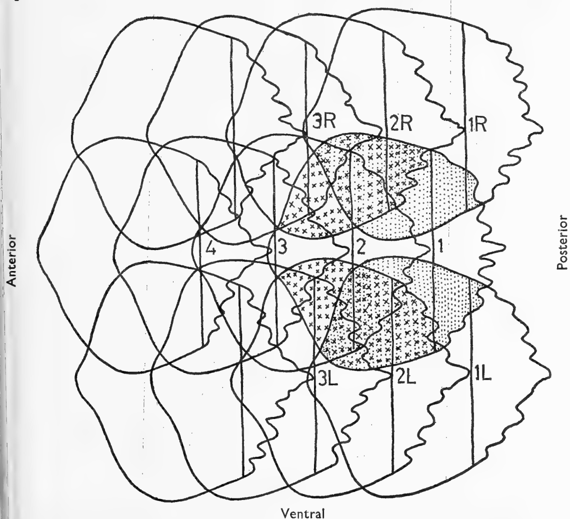

Fig. 3—Diagrammetic representation of the surface view of the arrangement of the scales from the middle of the lateral body wall of the fish. Scale 1 overlaps scale 1 R and 1 L (dotted areas). Scale 1 itself is overlapped by 2 R and 2 L (areas with crosses), the latter two scales being overlapped by scale 2 which is itself overlapped by 3 R and 3 L and so on.

Fig. 4.

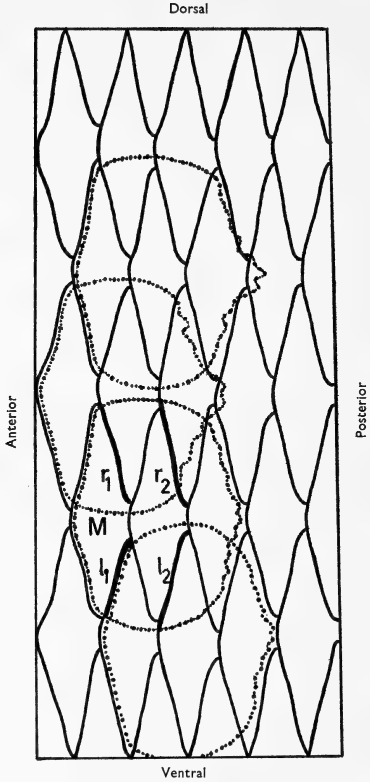

Fig. 4—Diagrammatic representation of the surface view of the anterior edges of scale pockets from middle of the lateral body wall of the fish. Four scales are shown with dotted outline. For l_1, l_2, r_1, r_2, and M, see text.

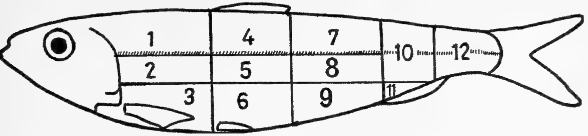

Fig. 5

Fig. 5—Division of the lateral body wall into twelve regions from which scales were removed for annuli studies. The hatched lines represents the scale row from which 43 scales were removed for fissure investigation. × 1.

This preliminary investigation on the annuli gives the following indications:—

1. The definition of an annulus as given by Walford and Mosher for *S. caerulea* can also be used to identify annuli in *S. gibbosa* and *S. albella.*

2. In *S. gibbosa* fish showing no annulus varied in length from 86 mm. to 131 mm., a range which nearly overlaps that of those showing one annulus (Table 3). On the other hand, the same table shows that fish with two annuli on their scales have so far been found only in the higher size groups, none of them being less than 123 mm. in length.

3. For the months of January, March, April and May, 1969, the percentage of fish with no annulus is higher than of those with one annulus and the proportion of the latter is greater than of those with two annuli (doubtful cases have been omitted). Until the causation of the annulus is established, it will be perhaps hazardous to extract any information from these figures.

4. If annuli on *S. gibbosa* scales are yearly registered marks, then the few year-groups (?) observed probably fits in with the other properties, viz. early maturity and annual spawning, of fish with a short life cycle (Nikolasky, 1963, p. 217).

Several workers have tried to investigate what induces the formation of annuli in some other fishes. For *E. mordax*, Miller (1955) says "that these rings are not spawning checks is shown by the presence of an annulus on young immature fish and by the presence of new rings already forming on the scales of most fish collected just before and during the spring spawning." Further, he establishes that these checks result from the retarded growth during late summer and fall, whereas most of the spawning is confined to winter, spring and early summer, the latter two periods being also the time when maximum growth of the fish and its scales takes place.

Newell (1957) mentions that F. Talbot found that "in the fishes of East African waters, a zoning is often present in the scales of many species. In *Lethrinus nebulosus* (Forskal) a check in scale growth has been found in September, the month of minimum temperatures".

On the other hand, Van Someren's work (1950; quoted from De Bont, 1967) on rainbow trout, *Salmo gairdneri*, living in the rivers of the foothills of Mount Kenya, showed that the annuli are spawning marks. In *Tilapia macrochir* Boulenger, De Bont (1950; quoted from his 1967 paper) found no correlation between spawning and the laying of annuli on the fish's scale.

For *S. gibbosa* work is in progress to find out whether annuli are spawning rings or whether they develop as a result of some other cause of unknown periodicity. Only

when this latter point is cleared, would it be possible to say whether or not annuli can be used as age indicators. For the moment, it seems that they are probably the best structures yet available as tentative indicators of age.

SUMMARY

1. Scales of *S. gibbosa* have been investigated in an attempt to find an ageing method for the fish from these structures.

2. The nature of the *striae*, posterior, dorsal and ventral fissures is ascertained. A suggestion is made as to how the fissures may be formed, although several difficulties are involved in the hypothesis.

3. Annuli of the clupeoid type have been observed and the validity of their use in age determination is the subject of further investigation.

ACKNOWLEDGEMENTS

I am greatly indebted to Dr. Mary Whitear, University College, London, for her assistance in going through the manuscript and in making quite a number of useful comments. I also wish to express my thanks to Mr. G. F. Losse for having allowed me to use some of his unpublished biological data, Prof. I. Griffiths for many helpful suggestions and for lending me literature.

I am grateful to the Research and Publications Committee, University College, Dar es Salaam, for giving me a grant to pursue the work on the local sardines.

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(Received 8th July, 1969)

NOTES ON KENYA *ACETABULARIA* LAMOUROUX, (CHLOROPHYTA)

By

SHAKUNTALA A. MOORJANI

University College, Nairobi

Acetabularia is a pan-tropical genus with extra-tropical extensions. It comprises about twenty species which are all marine. The mature thallus is calcified (in varying degrees according to the species) and has an erect, unbranched siphonous stipe terminating in one or more whorls of gametangial rays. The rays may be free or fused along their lateral margins and contain numerous spherical cysts at maturity. On the upper surface and near the base, each ray bears a coronal knob, which knobs jointly comprise the corona superior. Some species also have a corona inferior below the gametangial rays. The corona superior bears delicate, decidous hairs, which in certain species are rudimentary.

On the east coast of Africa, *Acetabularia* has been recorded in South Africa (Levring, 1938; Papenfuss & Egerod, 1957) and in Mozambique at Inhaca Island and Peninsula (Isaac & Chamberlain, 1958). As far as the author has been able to ascertain from the records available to her, the genus *Acetabularia* has not been previously recorded for the Kenya coast.

In this paper three species of *Acetabularia* are reported for the Kenya coast. The first of these *Acetabularia* was recorded in April, 1968. A piece of old coral on which *Udotea orientalis* A. & E. S. Gepp, were growing was collected on the coral reef at Diani Beach and brought to Nairobi to make further observations on this species. On this piece of old coral there appeared an *Acetabularia* which was identified as *A. moebii* Solms-Laubach by Prof. Wm. E. Isaac.

Again, earlier this year, some *Acetabularia* were observed on old coral in culture of *U. orientalis*. The laboratory culture consisted of three pieces of old coral which had been collected on the reef at Diani Beach on 4 April, 1969 and transported to Nairobi in a Polythene jar filled with sea water, from which they were removed a week later and transferred to a glass aquarium (12 in $\times 7\frac{1}{2}$ in $\times 7\frac{1}{2}$ in) which was filled with filtered sea water brought from the coast. Two petri dishes, full of clean sand from the coast, in which individual *Udotea* had been planted, were placed in the aquarium. The level of water in the aquarium was marked. The aquarium was placed on a bench near a window.

Daily from 8.30 a.m. to 4.30 p.m. the aquarium was exposed to illumination provided by a 100 watt Bench lamp which was placed on one corner of the aquarium. The heat from the lamp also helped to raise the temperature of the water from 18° to 24°C and maintain it for some time.

Aeration was provided by means of an aerator with polythene tubing ending in an air stone-diffuser.

Care of the culture involved only the adding of distilled water from time to time to replace the water lost by evaporation and thus maintain a constant volume and salinity. Algae growing on the walls of the aquarium were removed.

The first *Acetabularia* were seen growing a week after the culture had been set up in the laboratory. In the following weeks unbranched axes with terminal whorls of sterile hairs were noticed which later developed the characteristic disks of gametangial rays. The developmental sequence was followed and was found to be similar to the one described by Egerod (1952). Later three species were identified from the culture material. There may be a fourth species but at present this is uncertain.

The Kenya *Acetabularia* found are all small species. When mature, the thalli are between 3.0-10.0 mm. tall and the disks are between 1.5-4.0 mm. in diameter.

Following is a key to the Kenya species found.

KEY TO THE KENYAN SPECIES

1. Gametangial rays entirely free . . . . *A. clavata.*
   Gametangial rays not entirely free. . . . . 2.
2. Gametangial rays in contact throughout; broadly rounded or emarginate apices . . . . *A. moebii.*
   Gametangial rays partly adhering, mammillate apices. . . . . *A. exigua.*

Acetabularia clavata Yamada, 1934, p. 57, figs. 24 and 25. (fig. 1)

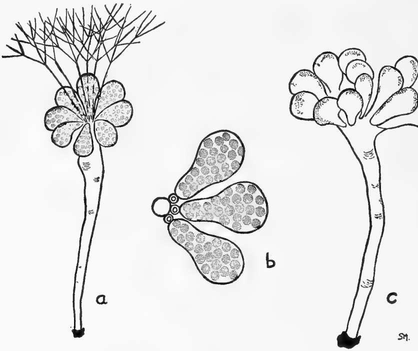

FIGURE LEGEND

Fig. 1 *Acetabularia clavata* Yamada.

a. A mature reproductive thallus (× 10).
b. Part of a gametangial disk, as seen from above (× 20).
c. A plant with two gametangial disks (× 10).

Egerod: *Univ. Calif. Publ. Bot.*, vol. **25**, No. 5, p. 413.

Thallus slightly calcified, 4.0-6.5 mm. high, stipe slightly rugose, bearing a single apical gametangial disk, 1.5-2.0 mm. in diameter, composed of 6-9 gametangial rays; the rays free and widely spaced, each ray clavate in shape with smooth rounded distal margin and containing numerous spherical cysts, 50-60μ in diameter; each coronal knob of corona superior bearing two or three sterile hairs; corona inferior lacking.

The Kenya plants are in general agreement with the description of *A. clavata* given by Egerod (1952) but are, however, larger in size. They grow up to 6.5 mm. in height.

Egerod mentions that *A. clavata* frequently occurs intermingled with *A. moebii*, to which it bears some resemblance and that although both species are of approximately the same size, they can be distinguished by the arrangement of the gametangial rays. Whilst it is true that the Kenya *A. clavata* also occurs intermingled with *A. moebii*, the two are not of the same size in culture. *A. clavata* is much smaller than *A. moebii* and it can be easily distinguished from it by the arrangement of the gametangial rays. The rays of *A. moebii* form a solid disk while those of *A. clavata* are free from each other (fig. 1b). Another distinctive character of *A. clavata* observed in culture is its

dark green disk. Egerod also mentions that the rays of Hawaiian *A. clavata* are equal in width throughout their length, but this is not the case in the Kenya plants in which the rays are clavate in shape.

Another observation made on the Kenya specimens is that there is a variation in the number (two or three) of hair scars on the coronal knobs of the same gametangial disk.

Egerod has reported that a number of Hawaiian plants of *A. clavata* had two gametangial disks at the apex. In the culture all the plants, except one, had a single apical disk. In the plant with two gametangial disks, the two disks were clearly alongside one another (fig. 1*c*) and not in two series as illustrated by Egerod.

Type locality: Ryukyu Islands.

Geographical distribution: PACIFIC OCEAN. Ryukyu Islands, Hawaiian Islands. INDIAN OCEAN. Kenya. Diani Beach, reef opposite Jadini.

Acetabularia moebii Solms-Laubach, 1895, p. 30, pl. 4, fig. 1. (fig. 2)

A. minutissima Okamura, 1912, p. 184 pl. 100.

A. wettsteinii Schussnig, 1930*b*, p. 338 (cf. Feldmann, J. & G., 1947, p. 81, fig. 1 & 2.)

Borgesen: "*Marine Algae from Mauritus*", 1950, p. 6, fig. 1.

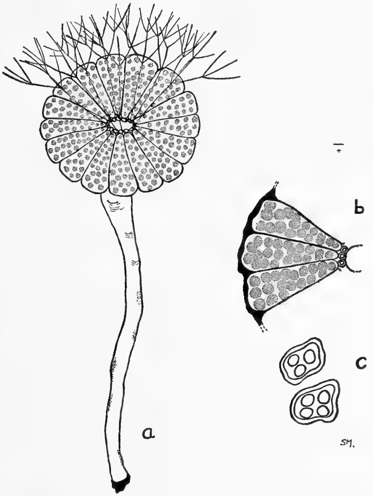

Fig. 2. *Acetabularia moebii* Solms-Laubach.
- ***a***. A mature reproductive thallus (× 10).
- ***b***. Part of a gametangial disk, as seen from above (× 15).
- ***c***. Coronal knobs with thin walled hair scars (× 200).

Egerod: *Univ. Calif. Publ. Bot.*, vol. **25**, No. 5, p. 411.

Thallus slightly calcified, 8-10 mm. high, stipe slightly rugose, bearing a single flat apical gametangial disk, 3-4 mm. in diameter, composed of 14-19 rays, the rays cemented together laterally through calcification, each ray cuneate with smooth broadly rounded or emarginate distal margin and containing numerous spherical cysts 79-158μ in diameter; each coronal knob of corona superior bearing 3-5 sterile hairs; corona inferior lacking.

The Kenya plants examined agree well with the description given by Egerod (1952) and Borgesen (1951). However, the size of the Kenya plants examined exceeds those described from Hawaii and Mauritius. Papenfuss (1957) and Isaac & Chamberlain (1958) have also made similar observations for *A. moebii* found on the east coast of S. Africa and Inhaca Island and Peninsula respectively. The Kenya plants reach a height of up to 10 mm and the disk has a diameter of up to 4 mm. The gametangial rays are in close contact laterally through slight to moderate calcification (fig. 2*b*). No disks with free rays were observed as have been observed by Egerod for the Hawaiian plants and by Borgesen for the Mauritius plants.

Borgesen (1951) quotes Solms-Laubach as stating that there are only five hair scars per coronal knob. In the Kenya plants 3-5 scars were observed. This is in agreement with Egerod and Borgesen who have observed similar numbers. In addition, it was observed that in the Kenya plants there is a variation in the number of hair scars on the coronal knobs of the same gametangial disk. This was also observed by Egerod for the Hawaiian plants. The hair scars of the Kenya plants (fig. 2*c*) are thin walled in agreement with Solms-Laubach and not thick walled as reported for the Mauritius plants.

Type locality: Mauritius.

Geographical distribution: ATLANTIC OCEAN. Mediterranean Sea. INDIAN OCEAN. Red Sea, Mauritius, east coast of Southern Africa, Kenya, PACIFIC OCEAN. China Sea, Japan, Hawaiian Islands, Southern Marshall Islands.
Kenya: Diani Beach, reef opposite Jadini.

Acetabularia exigua Solms-Laubach, 1895; p. 28, pl. 2. fig. 1, 4. (fig. 3)
E. Y. Dawson: *Pacific Sci.*, vol. **X**, No. 1956, p. 42.

Thallus slightly calcified, 3-6 mm. high, stipe slightly rugose, bearing a single apical disk, 1.5-3.0 mm. in diameter; disk flat or cup-shaped, composed of (6)-8-12 gametangial rays, rays slightly cemented together laterally for part of the length; each ray ovoid with mammillate apex and containing numerous spherical cysts, 79-95 μ in diameter; each knob of corona superior bearing two or three sterile hairs; corona inferior lacking.

This is a small plant like *A. clavata* but can be easily distinguished from the latter by its mamillate ray tips and also by its often cup-shaped disk (fig. 3*a*) in contrast to the flat disk of *A. clavata*. The rays in *A. exigua* are cemented together laterally for part of the length (fig. 3*b*) while they are entirely free in *A. clavata*. In many plants of *A. exigua* it was observed that the apices had broken off (fig. 3*c*).

There is a variation in the number of hair scars on the coronal knobs of the same gametangial disk.

In the laboratory culture, a plant was observed which had two gametangial disks in series but the lower disk was incomplete and had the gametangial rays in twos as shown in fig. 3*d*.

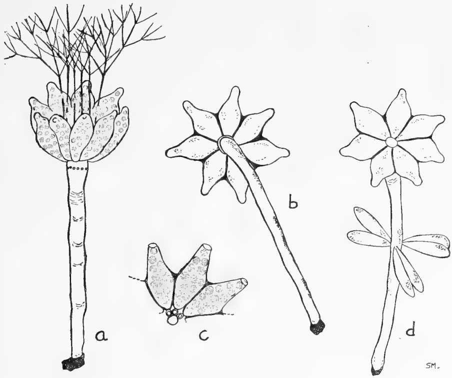

Fig. 3. *Acetabularia exigua* Solms-Laubach.

a. A mature reproductive thallus ($\times$ 10).
b. Ventral view of a gametangial disk showing lateral calcification of the rays ($\times$ 10).
c. Part of a gametangial disk with broken ray apices ($\times$ 15).
d. A plant with two gametangial disks ($\times$ 10).

Geographical distribution: "Tropical eastern Asia, Macassar, Celebes" (Solms-Laubach). INDIAN OCEAN. Kenya, PACIFIC OCEAN. Southern Marshall Islands.
Kenya: Diani Beach, reef opposite Jadini.

The *Acetabularia* grew very well in culture. Over the three months' period of study numerous plants developed in the aquarium and reached maturity. It was difficult to identify the different species during the early stages of development, but once the gametangial disk was developing it was easy to recognise the species.

From the examination of juvenile stages, a developmental series was traced. It seems in the main to agree with the developmental series outlined by Egerod (1952). The phenomenon of diaphysis was however not observed in the Kenya plants examined. It was also observed that when a shoot was initiating a gametangial disk at its apex, it did not always shed its sterile branches. Egerod writes that none of the plants from Hawaii contained more than one whorl of sterile hairs at any one time, but in many Kenya plants two whorls of sterile hairs were seen concurrently.

ACKNOWLEDGEMENT

I wish to thank Prof. Wm. Edwyn Isaac for his encouragement and assistance in the preparation of this paper; Dr. H. B. S. Womersley of the Botany Dept., University of Adelaide, for identifying the species; and Mrs. F. Isaac for collecting the old coral pieces earlier this year.

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* Monograph not seen by the author.

(Received 18th August, 1969)

THE LUGARD PLANT COLLECTION

By

E. M. TWEEDIE, P.O. BOX 215, KITALE, KENYA, AND A. D. Q. AGNEW,

UNIVERSITY COLLEGE, NAIROBI, KENYA.

INTRODUCTION

In 1930-31, Major E. J. Lugard came on a long visit to his son and daughter-in-law, Cyril and Kitty, who had a farm on the south-eastern slopes of Elgon at about 2042m. (6,700 ft.) The map reference for this farm is GAM 560.050 on sheet 88/11 of series SKI 11 (1958), 1:50000. Major Lugard was an experienced collector for Kew and he and Kitty (Mrs. C. E.) Lugard proceeded to make a thorough collection, on and around the farm and up the slopes of Elgon to the top. He it was who first encouraged one of us (E.M.T.) to take up collecting with the special aim of completing his collection, which was made only between October and May.

The collection numbered over 700, and was made, where possible, with much material from each plant. The best material was sent to Kew which deposited duplicates of many specimens in the East African Herbarium, and one incomplete set of plants was retained by the Lugards for their use and reference.

The importance of the collection lies in the fact that it was a comprehensive collection from Elgon and aroused interest at the Royal Botanic Gardens, Kew (England) where it was made the subject of special research by Mr. A. A. Bullock. This resulted in two publications: the first, in 1932, contained descriptions of 32 new species and the second, in 1933, was an enumeration of the entire collection. Since new species were described on the basis of this material, the specimens kept by the Lugards were valuable for there were many types amongst them.

However, since the Lugards left Kenya, all trace of their personal incomplete set of plants was lost and it was not until 1965 that an increasing interest in the local flora led to a search for the "Lugard Collection". It was well known that the original collection had gone to Kew, but it was thought that there could be duplicates in the Stoneham Museum, Kitale. We enlisted the help of Mr. R. J. Fulton, who, when Col. Stoneham was getting too old and ill to cope, had been assisting him in a neighbourly way. Mr. Fulton made an exhaustive search of the Museum, and with his aid we were convinced that there was no worthwhile botanical material there.

Rediscovery

In May 1968, Col. T. H. E. Jackson ("Pinky") was murdered. Soon after this, one of us (E.M.T.) had a long talk with Mrs. Cooper, the wife of the farm manager, who has been there for 23 years. The talk was of botanical and horticultural problems arising from the murder and, in the course of it, Mrs. Cooper mentioned some dried plants lying in the roof of their house. We at once realised that this might be the Lugard Collection, because the Coopers' house originally belonged to the Lugards.

Col. Jackson's sister, Mrs. Symes, kindly suggested that one of us (E.M.T.) should have charge of the bundle of plants. This turned out to be a well-preserved, tightly bound package of scraps and whole plants secured to herbarium drying paper with glue. Each sheet of paper had one to many whole plants or fragments glued to it, with numbers associated with each specimen on the sheet, and occasional additions in a later hand.

The collection

The collection has been curated by one of us (A.D.Q.A.) with care. The multiple-specimen sheets were cut up, retaining their numbers and specimens with their underlying paper. There were some later, whole-plant collections which were unnumbered and there were some numbers on the sheets which did not correspond to any plant material thereon. However, this was easy to check upon since numbers were generally consecutive upon one sheet.

Mrs. C. E. Lugard has (*in lit.*) assured us that this parcel is in fact a duplicate of the Kew collection. The authenticity of the plants is further confirmed by the numbers, which match those cited in Bullock's publication. The specimens themselves in many cases have probably come from the same individual plant as is already represented in the East African Herbarium. For example, *Sphaerocodon obtusifolium* Benth. (Lugard 618) is a species which has never since been gathered in Kenya, but of which we now have two specimens apparently from the same plant, which differs in its growth form from specimens from other areas (e.g. Uganda).

The collection contains 368 numbered specimens which include isotype and paratype material of 27 species. The collection as a whole is now housed in the Herbarium of the University College, Nairobi. All type specimens, of which Table 1 is an enumeration, have, however, been lodged in the East African Herbarium, together with an annotated list of first Kew determinations and some relevant correspondence kindly sent to us by Mrs. C. E. Lugard.

TABLE 1

Type of material present in the re-discovered personal collection of Major E. J. and Mrs. C. Lugard. Arrangement is after Hutchinson (1926) with alphabetical order within families. Authorities are all those of Bullock unless otherwise stated. An *isotype* is a duplicate (collected at the same time, with the same number) of the holotype, while a *paratype* is a specimen cited at the time of the first description.

Name	*Numbers*	*Earlier synonym* (if any)
Crassula erubescens	422 (isotype)	
Crassula wrightiana	215 (isotype) 538 (paratype)	C. granvikii Mildbr.
Kalanchoe lugardii	115 (isotype)	
Impatiens phlyctidoceras	313 (isotype)	
Combretum elgonense Exell	524 (isotype)	
Hypericum afromontanum	338*a* (paratype)	
Euphorbia euryops	380 (isotype)	E. repetita A. Rich.
Astragalus elgonensis	334 (isotype)	A. atropilosulus (Hochst.) Bunge
Crotalaria lugardiorum	197 (paratype)	
Trifolium lugardae	97 (isotype)	
Tylophora lugardii	656 (isotype)	
Galium afroalpinum	365 (paratype)	G. ruwenzoriense (Chiov.) Hedb.
Galium mollicomum	400 (isotype)	G. ossirwaense K. Krause
Oldenlandia scopulorum	346 (isotype)	
Senecio lugardae	541 (isotype)	S. hochstetteri Sch. Bip.
Chironia elgonensis	21 (isotype)	
Swertia lugardae	409 (paratype)	
Plumbago montis-elgonis	637 (isotype)	
Lobelia melleri Hemsl.	149 (isotype)	
var. grossidens E. Wimm. Kew Bull, 1952:139	variety	L. anceps L.f.
Calamintha elgonensis	363 (isotype)	Satureia uhligii Guerke
Leucas tricrenata	471 (paratype)	
Commelina elgonensis	549 (isotype)	
Commelina lugardae	145 (isotype)	
Urginea porphyrantha	556 (isotype)	
Crinum heterostylum	421 (isotype)	
Holothrix elgonensis Summerh.	379 (paratype)	
Satyrium dizygoceras Summerh.	595 (isotype)	S. volkensii Schltr.

PLANTS CITED IN THE TEXT WITH NAMING AUTHORITY

Anthericum gregorianum Rendle
Aristida adoensis Hochst.
Cassia mimosoides L.
Coleus caninus (Roth) Vatke
Craterostigma hirsutum S. Moore
Craterostigma spp.
Croton dichogamus Pax
Cyperus spp.
Dombeya burgessiae Gerrard
Eragrostis braunii Schweinf.
Eragrostis hispida K. Schum.
Eriochloa nubica (Steud.) Thell.
Erythrococca bongensis Pax
Euphorbia rivae Pax
Evolvulus alsinoides (L.) L.
Fimbristylis spp.
Fuerstia africana Th. Fr.
Gnidia subcordata Meissn.
Grewia similis K. Schum.
Harpachne schimperi A. Rich.
Hyparrhenia collina (Pilger) Stapf
Hyparrhenia filipendula (Steud.) Stapf
Ilysanthes pusilla Urban
Justicia whytei S. Moore
Kyllinga erecta (Schum.) C. B. Cl.
Kyllinga leucocephala Boeck.
Leonotis nepetifolia R. Br.
Lippia javanica (Burm. f.) Spreng.
Nesaea erecta G. & P.
Ochna ovata F. Hoffm.
Oldenlandia herbacea Roxb.
Olea africana Mill
Panicum maximum Jacq.
Pennisetum spp.
Psiadia arabica Jaub. & Spach
Rhychelytrum repens (Willd.) C. E. Hubb.
Rhynchosia elegans A. Rich.
Senecio discifolius Oliv.
Setaria verticillata (L.) Beauv.
Solanum incanum L.
Sporobolus discosporus Nees
Sporobolus usambarensis Gilg
Themeda triandra Forsk.
Trachyandra saltii (Bak.) Oberm.
Turraea mombassana DC.

ACKNOWLEDGEMENTS

This collection would not have been found without the help and co-operation of Mrs. M. Cooper, Mrs. Symes and Mrs. C. E. Lugard. To them, and to Mr. R. J. Fulton, we are sincerely grateful. Mr. J. B. Gillett made valuable criticisms of the manuscript of this paper.

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(Received 16th March, 1969)

OBSERVATIONS ON COLONIAL BREEDING IN THE BLACK-HEADED WEAVER AND VIEILLOT'S BLACK WEAVER

By

J. R. Hall

University Department of Education, St. Thomas' Street, Newcastle upon Tyne, NEI 7RU, U.K.

INTRODUCTION

The observations reported here were carried out near Kampala between 1962 and 1966. The species involved, the Black-headed Weaver *Ploceus cucullatus bohndorffi* (Reichenow) and Vieillot's Black Weaver *Melanopteryx nigerrimus nigerrimus* (Vieillot), are the commonest weaver birds in that area. General descriptions may be found in Jackson (1938), Bannerman (1949), Chapin (1954) and Mackworth-Praed & Grant (1955). One of the most striking features of their biology is the frequent occurrence of colonies of both species in the same site. Questions as to why this happens lead to a consideration of the advantages of colonial breeding, which are uncertain. At the same time, since these weavers appear to be closely similar in habits and ecology, problems of inter-specific competition are raised. The data described throw some light on these problems.

OCCURRENCE OF SHARED SITES

P. cucullatus and *M. nigerrimus* are typical colonial weavers. Colonies in the Kampala area were most often built in bamboo or trees near houses; cassia, eucalyptus, and palm being favoured most. When sharing a site, nests of the two species were not normally intermingled but formed distinct, although contiguous, colonies.

The formation of colonies of weavers containing two or more species is not uncommon. Various examples are mentioned in the literature (see especially Bannerman, 1949) and the following combinations were noted in this study: *Ploceus jacksoni* (Shelley) and *M. nigerrimus*; *Ploceus capitalis* (Latham) and *M. nigerrimus*; *P. aurantius* (Vieillot) and *P. jacksoni.*

The data of Table 1 were obtained during the course of a survey in which the study area was traversed by car and all colonies within sight of the road recorded. At the same time the number of potential breeding sites was estimated, a potential site being a tree or group of trees of species known to be favoured, separated from the nearest dwelling by not more than five yards approximately. This provided a conservative estimate, since weavers might occasionally nest in unusual sites and more than one colony of the same species be built in the same tree or group of trees. Nevertheless the number of shared sites (24) was considerably greater than that expected as a result of chance distribution of colonies among available sites (4.3). The difference is highly significant ($x^2 = 108$; $P < .0005$) showing that the occurrence of sharing is not due to a shortage of apparently suitable sites.

Table 1

FREQUENCY OF SITES SHARED BY *P.CUCULLATUS* AND *M.NIGERRIMUS* IN RELATION TO FREQUENCY OF UNSHARED SITES AND TOTAL NUMBER OF POTENTIAL BREEDING SITES

	Sites occupied by *P. cucullatus*	Sites not occupied by *P. cucullatus*
Sites occupied by *M.nigerrimus*	24 (4.3)	6 (25.7)
Sites not occupied by *M.nigerrimus*	33 (52.7)	334 (314.3)

(Note: figures in brackets are expected numbers assuming random distribution of colonies amongst available sites.)

P. cucullatus colonies in sites where *M. nigerrimus* was also present tended to be larger than those where this was not so. Thus in a sample of 24 shared sites colony size varied from about 20 to 120 nests with a mode of about 50, whereas in 28 unshared sites the size range was approximately five to 100 with a mode of 30. A simple explanation of this may be that large *P. cucullatus* colonies are more attractive to *M. nigerrimus* than smaller ones. A similar comparison cannot be made for the size of *M. nigerrimus* colonies because only five not sharing with *P. cucullatus* were recorded.

COLONIAL BREEDING AND PROTECTION FROM PREDATION

Presumably by breeding together these two species share and enhance the advantages of colony formation, whatever they may be. The above evidence does not support the view that it is the advantage of the protective nature of the site alone which is relevant. It is true that weaver breeding sites generally appear to have protective features, such as siting over water, in thorn trees or near houses (which may serve to keep ground-based predators away), but if there is no shortage of such sites this cannot explain the formation of colonies or the sharing of sites by different species.

Perhaps the most widely accepted hypothesis about the origin and advantages of colonial breeding supposes that it confers the same increased protection as flock formation in general. Lack (1954) discusses this and quotes evidence in support, none, however, relating to weavers. More recently Patterson (1965) has produced impressive supporting evidence in the case of the Black-headed Gull *Larus ridibundus* (Linn.). The protective value of the colony is thought to derive partly from increased awareness of the approach of predators and partly from the occurrence of mobbing. Darling (1938) also suggests that synchrony in the breeding of colonial birds reduces losses by predation because it limits the length of the breeding period and so the time during which predators may attack eggs and young. This is discussed by Kruuk (1964), Patterson (op. cit.) and—in relation to the Quelea, *Quelea quelea* (Linn.)—by Lack (1966). The presence of synchronised breeding has been demonstrated in the present species (Hall, (1970), However these hypotheses assume the existence of high predation pressure. In fact attacks on weaver colonies seem remarkably infrequent. During many hours spent in watching these birds during the course of four years I witnessed only three and received first hand accounts of only a few more. Details are given below.

(i) King's College, Budo, 1964 (precise date not recorded).

All the members of one colony were seen to have left it and to be perching on a tree about 30 yards away. A small hawk (unidentified) was perching at the top of the tree containing the colony, making no attempt to attack the nests containing chicks. I was unable to stay long enough to see what eventually happened.

(ii) Near Kampala, November, 1965.

All birds (*P. cucullatus* only) suddenly left the colony on the approach of a large hawk, African Goshawk *Accipiter tachiro* (Daudin). The latter perched in the tree until a few minutes later a female weaver returned to the site and was attacked. Both birds flew out of sight, but ten minutes later a hawk (possibly the same bird) flew past with prey in its claws.

(iii) Near Budo, February, 1966.

A pair of crows *Corvus albus* Müller was seen attacking the nests in a colony of Black Weavers. They persisted in this in spite of vigorous mobbing by the weavers.

(iv) Budo, 1962 (reported to author).

A *M. nigerrimus* colony was attacked by a party of Casqued Hornbills *Bycanistes subcylindricus* (Sclater). The colony was completely destroyed and never re-occupied. (This may be compared with a report by Bannerman (1949) of a colony of *Melanoploceus tricolor* (Hartlaub) containing more than 500 nests which was completely destroyed in a few days by a variety of birds, including "kites, crows, vultures, goshawks, buzzards, a crested hawk eagle and especially a pair of harrier hawks.")

(v) Budo, 1963 (reported to author).

A single Casqued Hornbill attacked the nests in a mixed colony of Black and Black-headed Weavers. The bird was shot and did little damage. Hornbills were very frequent visitors to the school compound at Budo and it seems remarkable that these attacks were not more frequent.

Only three attacks ((i), (iv) and (v) above) were recorded during my four years' residence at Budo, where I should almost certainly have been informed of any which did occur. There were generally five active breeding sites and, allowing for two breeding seasons each year, the destruction of one colony in four years represents an average loss of only $2\frac{1}{2}$ per cent. This is very small compared with losses which have been recorded for other species. Lack (1954) gives data showing that losses from all causes in open-nested nidicolous birds from laying of eggs to departure of young vary from 41 to 78 per cent, averaging about 55 per cent. Lack considers that in passerines three-quarters of losses are probably due to predation.

The concentration of nests in a colony and the impossibility of concealing them must much increase their liability to attack and the actual rarity of attacks implies the existence of an effective deterrent. The above evidence shows that this deterrent is not mobbing, since this occurred in one case only, but the fact that the hawks did not attack nests suggests that it may be the difficulty of dealing with them which deters predators. The fact that weaver nests hang from the ends of twigs must make it very difficult for heavier predators to attack. It is of interest that the only breeding success data given by Lack (op. cit.) for a bird with a suspended nest (the Orchard Oriole *Icterus spurius*) show a loss of only 20 per cent. It may be, therefore, that, rather than the colonial habit being a response to predation, it is the protective value of the weaver nest which makes colonial breeding possible and that the latter has evolved for some other reason.

ECOLOGICAL CONSIDERATIONS

According to Gause's principle species which have identical or closely similar ecological requirements are unlikely to exist in the same habitat. *P. cucullatus* and *M. nigerrimus* are closely related—Moreau (1960) places them in the same genus—and have very similar habits, the details of breeding behaviour, for example, varying very little (Crook, 1963). Both are said to be predominantly granivorous (e.g. Crook, 1964; Mackworth-Praed & Grant, 1955). On the face of it, therefore, Gause's principle might seem to be contradicted in this case. Accordingly, in an attempt to gauge the degree to which ecological requirements differ, data relating to distribution and food preferences are presented below.

On the continental scale *P. cucullatus* is much more widely distributed than *M. nigerrimus*, which is limited to moister environments, and the same difference has been demonstrated on the local scale in Uganda (Hall, 1968). There *M. nigerrimus* is limited to areas containing forest, whereas *P. cucullatus* also exists in drier habitats. This implies a difference in ecological requirements.

Lack (1954) has shown that the numbers of many bird species are limited by shortage of food and it follows that differences in food preference must constitute an important factor governing the extent of interspecific competition. Little detailed evidence con-

cerning food preferences in the present species is available. Examination of the gut contents of eight adult male *M. nigerrimus* (March, 1966) revealed the presence of vegetable matter but not grass seeds in all but one and of abundant insect remains in all but one. In an adult male *P. cucullatus* collected on the same occasion and another collected in November, 1965 the bulk of food consisted of grass seeds with small trace of insect material. However A. D. Forbes-Watson (pers. comm.) reports contrary evidence from specimens collected in Liberia [sub-species *P. c. cucullatus* (Müller) and *M. n. castaneofuscus* (Lesson)]:

> "Only a single *P. nigerrimus* out of twenty-nine had insect fragments, and even this had seeds as well. Four out of eleven *P. cucullatus* had insect fragments (with no trace of vegetable matter).
>
> "Each morning flocks of *P. cucullatus* would be catching insects (mostly moths) attracted to our mercury vapour lamp, but I never saw *P. nigerrimus* doing this, though this latter species was the commoner."

Clearly the diet of these birds may be very varied.

Kear (1962) and Newton (1967) have shown that in British finches (Fringillidae) preferred size of seed taken is related to bill size. Marked differences in food selection were demonstrated between species differing by approximately 15 per cent in bill dimensions. Conversely Ward (1965) shows that seed size is the chief factor determining selection between different species of grass seed by the weaver *Quelea quelea*. Table 2 shows mean values for bill dimensions of *P. cucullatus* and *M. nigerrimus*. The differences between the species are probably large enough to be associated with significant differences in food selection.

TABLE 2

DIMENSIONS OF BILL IN *P.CUCULLATUS* AND *M.NIGERRIMUS*

Species and sex	Length: (mm) mean	s.d.	Depth: (mm) mean	s.d.	Number in sample
P.cucullatus male	16.1	0.8	12.1	0.8	18
,, female	15.0	0.5	10.25	1.0	8
M.nigerrimus male	14.4	0.4			26
,, ,,			10.1	0.5	18*
,, female	13.7	0.8	9.8	0.3	9

(* Note: obvious errors in measuring depth made it necessary to discard measurements taken from 8 of the sample of *M.nigerrimus* males.)

In the course of a trial colour banding project weavers were caught by means of a house trap baited with bread crumbs placed near breeding colonies. Male Black-headed Weavers only were attracted by this bait, a fact which indicates a difference in foraging behaviour and possibly in food preferences between these birds and females of the same species and both sexes of the Black Weaver.

This rather scanty evidence indicates that whilst ecological requirements must broadly overlap there are also definite indications of differences between the species, particularly in food preferences. A detailed study of food selection would be interesting.

DISCUSSION

The evidence described shows that the association between colonies of *P. cucullatus* and *M. nigerrimus* is not fortuitous, pointing to the existence of some advantage of colonial breeding which may be shared by different species. The hypothesis that this advantage lies in the protective value of the colony is not supported by the evidence.

An alternative proposed by Crook (1964, 1965) links colonial breeding with flock formation for foraging purposes. It is shown that gregariousness, colonial breeding and the use of seeds as food are correlated in the weavers (Ploceinae), which include insectivorous solitary nesting forms. The suggested explanation is that food in the form of seeds is most efficiently exploited by birds foraging in flocks, whereas insectivores feed most effectively as individuals or in small groups. However this explanation disregards the fact that most colonial weavers, although mainly granivorous as adults, feed their young on insects. (It has been shown that the food of *M. nigerrimus* chicks consists almost entirely of insects (Hall, in press (*b*)). Close observation of females in a colony does not suggest that they are collecting food as a flock.

An interesting parallel is afforded by the British finches. Newton (1967) states that some of the cardueline finches nest in groups or "loose colonies" and relates this to the fact that they feed their young mainly on seeds for which they forage communally. Fringilline finches, on the other hand, feed their chicks on insects or other invertebrates, foraging individually, and always nest solitarily in territories; they are, however, social outside the breeding season, when their food consists mainly of seeds. Thus, as noted by Lack (1954), there is no necessary connection between flock formation outside the breeding season and sociality within it; in fact on the basis of Crook's theory one would expect these weavers to be solitary nesters, rather than the converse.

According to the hypothesis of Wynne-Edwards (1962) the primary function of social organisation in animals is to regulate numbers through the control of reproductive rate. Applied to colonial birds this would imply that the size and number of colonies would be limited in relation to the resources of the habitat, so that a sudden increase in population would not lead to over-production of offspring, because surplus individuals would be excluded from colonies. Weaver colonies are known to occupy the same sites for long periods and the establishment of new permanent colonies seems to be infrequent. The size of a colony appears to remain quite constant from year to year, although there is little exact data. However the occurrence of polygyny in the present species must nullify any regulative effect of relatively fixed colony size, since although males may be excluded from a full colony, there is no evidence that females are or might be.

Wynne-Edwards' hypothesis might explain the existence of mixed colonies as a means of mutually adjusting the numbers of two competing species to avoid over-exploitation of the habitat. This would imply that the numbers of the two species occupying shared sites would be inversely proportional: a large number of one would tend to be accompanied by a small number of the other. Analysis of data from 24 shared sites showed that this was not so.

This discussion leads to the somewhat negative conclusion that, whereas the evidence casts doubt on a widely accepted hypothesis explaining the formation of breeding colonies as applied to the present species, at the same time it lends little support to the two alternatives discussed. The one positive conclusion is that there is a definite relationship between the species leading to the sharing of breeding sites, which calls for explanation.

SUMMARY

The paper discusses the relationship between the colonial weavers *Ploceus cucullatus* and *Melanopteryx nigerrimus* and the possible function of colonial breeding. Evidence is presented indicating that the sharing of breeding sites by the species is not fortuitous, suggesting the existence of an advantage in colonial nesting which may be shared by different species. Observations of predation on weaver nests are described, showing that attacks are remarkably uncommon and casting some doubt on the theory that the chief function of social breeding is to provide protection from predation. Two other theories

about colonial breeding do not seem adequately to account for the facts. Limited evidence is presented relating to competition between the species.

I am grateful to Mr J. G. Williams, who kindly provided data for Table 2 from specimens in the National Museum, Nairobi, to Mr. J. White of Budo, who provided a number of specimens and to Mr. A. D. Forbes-Watson who communicated the observations on food selection recorded on p. 5. Dr. J. H. Crook gave much advice and encouragement throughout the study.

ACKNOWLEDGEMENTS

The observations were made while the writer was engaged in research for an M.Sc. of the University of East Africa, the work being supported by a grant from the Makerere University College Research Fund. I am indebted to Professor D. F. Owen for help and advice given during the course of this research and to Mr. Richard Kennedy who discussed this paper with me whilst it was in preparation.

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(Received 1st July 1968)

DATA FROM A COLONY OF VIEILLOT'S BLACK WEAVER, *MELANOPTERYX (PLOCEUS) NIGERRIMUS* VIEILLOT

By

J. R. Hall

In September 1965 it became necessary to destroy a colony of Black Weavers on the school compound at King's College, Budo, near Kampala. The writer was present and was able to remove approximately half of the nests individually and so obtain a record of their contents and a number of specimens of young for analysis of gut contents. The resulting data throw light on the sex ratio in the colony, clutch size, spacing of hatchings and food of the nestlings.

The total number of nests present was 59 and 30 of these were removed for examination. They represented an entire section of the colony and may be regarded as a representative sample of it.

Number of occupied nests.

In this species the main structure of the nest is built by the male, generally before pair formation, and the female then adds the soft lining of the egg chamber. After a nest has been accepted by a female the male proceeds to build another nest and to attempt to attract another mate. The numbers of incomplete and occupied nests in the sample were as follows:

Nest without lining of egg chamber: ..	9
Nests with lining (complete or not) but no eggs or young:	4
Nests with eggs and/or young:	17

Two of the nests without contents had complete linings and it is *possible* that these had been occupied but vacated after fledglings had flown. However, they appeared to be fresh structures and it seems likely that in fact no vacated nests were present. The writer has evidence (as yet unpublished) to show that in an active colony nests are very often destroyed soon after fledglings have left them. Accordingly it is probable that out of the 30 nests 21 were tenanted by females.

Just before the colony was destroyed an estimate was made of the number of males present and according to this there were 18 in the whole colony. In the half colony one would therefore expect 9—a number exactly equal to the number of nests untenanted by females. The ratio of males to females in the colony was therefore approximately 2:1. However, this does not take into account any females which might have left, having been present at an earlier stage.

Numbers of eggs and young present.

All eggs contained developing embryos. Young varying in age from newly hatched chicks to fledglings ready to fly were present. The contents of nests were as follows:

Number of nests.	*Contents* *Eggs*	*Unfeathered chicks*	*Feathered chicks*
2	1	0	0
5	2	0	0
3	1	0	1
3	0	1	0
2	0	2	0
2	0	0	1
2	0	0	1

It will be noted that in no case was the clutch larger than 2. (According to Jackson (1938) and Bannerman (1949) the clutch size is usually 2 but occasionally 3.) It is interesting that in three cases there was evidence of long delay between hatchings, since a chick at an advanced stage was present in a nest containing an unhatched egg.

Gut Contents.

Eleven chicks were killed (the twelfth, being capable of flight, was released) and the contents of their gizzards removed for examination. The food was examined microscopically and also tested for the presence of starch by means of iodine. There was no obvious difference in gut contents in the chicks of differing age. In all cases insects made up the greater part of the food, vegetable matter being almost completely absent. There were no recognisable grass seeds (which are believed to form a major component of the adult diet, see Crook (1964), Mackworth-Praed & Grant (1955)). In one case only was there a trace of starch. It was impossible to identify insect species, but several grasshoppers were present. There were also pieces of snail shell in one specimen.

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(Received 1st July, 1968)

NATURE NOTE

CROWN HAWK-EAGLE RAIDS HORNBILL NEST

The following observations were made at about 1:00 p.m. on January 19th 1964 while birding along the road from Fort Portal to Bundibunyu, Uganda, just at the point where the road ends its descent from the northern tip of the Ruwenzori Mountains. Here the road first reaches level ground and enters the eastern edge of the Bwamba Forest.

While standing by the side of the road, my attention was drawn to some loud scolding disturbance came into view, a large hawk that proved to be a Crowned Hawk-Eagle *Stephanoaëtus coronatus* (Linn.). It crossed the road over my head and perched in a large tree in full view about 30 metres from me. Through my binoculars I could see that it was carrying a small bird in its talons. After a few moments it moved to the edge of a large nest which I had not previously noticed built in the crotch of the same tree about 20 metres above the ground. The author of the scolding noises came into view at about the same time and landed in a tree on the opposite side of the road from the Hawk-Eagle's nest tree about 20 metres from me. It proved to be an adult male Black-Wattled Hornbill *Ceratogymna atrata* (Temmiack). At first it was unclear why the hornbill should be pursuing the hawk so vigorously, but on examining the hawk's prey more closely I saw that it was a young hornbill, which I would guess to be less than half grown since it was only about 20 centimetres long and was not close to being fully fledged. Pin feathers were quite visible on the wing coverts.

The size of the young hornbill and the fact that it was unfledged suggest that it had still been confined to the nest cavity. In this case, we must assume that the hawk reached into the nest hole with its foot or bill to take the young hornbill. But this assumption produces a major problem: Where was the female hornbill? The author is unaware of any definitive study in the Literature on the genus *Ceratogymna*, but it is known that in a closely-related genus of forest hornbills (*Bycanistes*) the female usually lays but one egg and stays sealed in the nest until the young is ready to fly, both female and young being fed by the male until that time. This contrasts with the behaviour of some dry-country hornbills (*Tockus* spp.) where the female is known to chip herself out prior to the young being able to fly and then assists the male in feeding it. Assuming that the life history of the two closely-related genera of forest hornbills is similar, the Hawk-Eagle must have had to kill or disable the female in order to get at the young. A question remains whether the hawk would go to that much trouble for a meal since from her protected position inside the nest the female hornbill should have been a worthy adversary with her large bill. While *Stephanoaëtus* occasionally takes hornbills as prey even of the size of *Ceratogymna*, it surely must be unusual for this Hawk-Eagle to reach into a nest cavity and take the young without killing or disabling the female hornbill first. A parallel type of nest robbing is known in another widespread East African predator, the Harrier-Hawk *Polyboroides typus* (Smith) which takes young weavers (*Ploceus* spp.) from their nests.

On the other hand, while it seems unlikely, it may be that the life history of *Ceratogymna* resembles that of *Tockus* more closely than that of *Bycanistes* in that the female leaves the nest cavity well before the young are fledged. If this is the case it provides an explanation for how the Hawk-Eagle could get at the hornbill nestling without interference from inside the nest but does not explain why the female hornbill did not join the male in pursuing and scolding the Hawk-Eagle. Possibly she was already disabled in defending the nest or was far away in the forest collecting food when the hawk attacked the nest. Only further study of the natural history of this hornbill is likely to solve the questions raised above about the whereabouts of the female.

The author wishes to express his deepest appreciation to Mr. G. Stuart Keith for suggesting that this note be written and for extensive help on the content of it.

18th June 1969. *ALLAN R. KEITH.*

M. E. W. North (*Ibis* 1942:505) records that all five nests of *Tockus* hornbills he found were provided with what he aptly calls "funk-holes," into which tree the confined female clambers on the slightest alarm (confirmed by myself and A. G. W. Root pers. comm.) Keith's *Ceratogymna* female may have escaped from a nest predator, by using a similar "funk-hole." A. D. F-W.

BOOK REVIEWS

CONSERVATION OF VEGETATION IN AFRICA SOUTH OF THE SAHARA

Hedberg I. & O. (Editors)

Acta Phyto Geographica Suecica 54 Uppsala 1968, XII+322 pp., 60 figs., obtainable from Almquist & Wanksell, International Booksellers and Publishers, 26 Gamla Brogaton, S-111 20 Stockholm, Sweden, price E.A. Shs. 97/-.

The keynote of this excellent publication is struck on page 1. Why conserve natural vegetation? The answer is quite clear. It is because of, and not in spite of, the human population explosion that it is now essential to take stock of our botanical background. Only by understanding and cherishing the environment upon which our existence depends can the pressing land use problems of today be solved.

Much of African's 20 million km^2 of vegetation cover is adapted to erratic rainfall and poor soil. It has not stood up to the increasing population pressure. The cruel fact remains that much of Africa has only reached the threshold of nationhood at the expense of an increasingly degraded environment.

Deforestation, fire, overgrazing, erosion and advancing aridity have practically brought the continent to its knees. Nevertheless natural ecosystems are resilient and provided conservation practices are approved and supported by governments now, the resources of Africa's vegetation could be rehabilitated. The cure will be expensive. The high reclamation costs already far exceed the means of Africa. But "the Mixture" must be taken by the leaders and people of Africa in big doses.

The "new look" of forestry, agriculture, ranching and wildlife conservation is a topic of world-wide interest. Funds and skills are becoming increasingly available to save the African environment. Every opportunity must be taken to administer them wisely. It is the conservationist's hope that future generations will inherit a land they can use and not waste.

Objects and reasons, explanations and solutions, must be understood by every one. This book tells us plainly what is happening to our environment and what must be done now by us for the future, country by country, in West, East, Central and Southern Africa.

In West Africa the pressing necessity is to preserve samples of common place vegetation in view of the rapid destruction of natural forests. The object should be to reserve natural habitats so that the ecosystem remains self-perpetuating. To this end a national park or similar sanctuary is often better than a forest reserve because the latter are maintained solely as a source of timber.

Little has been done to afford protection to special vegetation types and rare species of plants. Long term public education and funds are needed to achieve this in the best possible way.

In Eatern Africa there has been both progress and neglect. Only meagre results have been achieved in Ethiopia, Somalia and Socotra although the vegetation is of the greatest scientific interest. Deforestation and excessive grazing constitute the gravest threats. Suggestions for protection and conservation need to be tied to economic advantages if they are to be taken seriously.

Floristically Uganda occupies an interesting position at the junction of several vegetation types. The forests have, however, been degraded towards secondary fire subclimax grassland by the growth of human and animal populations. Several indigenous associations of the lowland vegetation are now protected in national parks where scientific studies are being made on fire and animal control. Suitable legislation is enforced.

In Kenya 'game' conservation is well over 50 years old but it is only recently that the habitats have been studied. The touristic appeal of both are now realised and the educational and scientific aspects of national parks is being planned. A special 'plant sanctuary' has been established at Mutomo hill, the first of its kind and it is hoped the forerunner of many others.

Tanzania's poor and erratic rainfall combined with the low fertility of the plateau soils makes agricultural development difficult.

The pressing need to improve the standard of living for the 98 per cent of the population that is dependant on the land has already strained the natural resources. Shifting cultivation, overgrazing and uncontrolled fires continues to destroy forests and pastures throughout the country. Vast areas cannot be settled because of tse-tse flies. There are however parts of unparalleled scenic beauty and animal wealth which are already national parks attracting an increasing number of overseas visitors.

In the south tropical African countries there has been an urge to create national parks for recreation and tourism and to these have been added smaller areas of archaeological and historical interest.

In Zambia parts of which are sparsely inhabited the plant catena survives and the greatest need is fire control. Investigations on the effects of fire on plant succession have already been carried out. Early burning has proved successful but shifting cultivation has degraded much of the natural woodland.

Malawi was a well wooded and sparsely inhabited country 100 years ago but recently the vegetation has been degraded by fire. Forests survive as small scattered patches the submontane types with west African affinities being of special interest. The suggestion is made that plantations to supply fuel and poles would relieve pressure on these indigenous forests. Botanical reserves of educational value might be made the responsibility of the people.

Protective legislation in Mozambique is relatively old, the Gorongosa National Park was established in 1921. Enforcement of the law and education of the people are present requirements. A good suggestion is the starting of 'micro-parks' for the preservation of rare species of animals and plants.

The sparsely populated pastoral countries are dependant on habitat conservation for economic survival. Although in some cases only a water supply is needed it is pointed out that the provision of boreholes might cause an imbalance between the animals and pasture unless properly supervised.

South Africa is noted for endemic species. Although the Cape vegetation has been subjected to fires for centuries it is considered to be well adapted to them and regeneration is good. Public interest has increased in all aspects of ecosytem conservation. Nature and wild flower reserves have been established and such could be extended to private land.

Nevertheless it is noted that overgrazing and erosion wherever the plant cover is delicately balanced with the environment have resulted in the spread of desert conditions. In 30 per cent of the country the complete disappearance of indigenous vegetation has occurred.

In S. W. Africa vegetation is only protected in game reserves. In the tribal areas land husbandry education is much needed. The government of Swaziland has powers to confine grass burning to the most desirable season and to prohibit cutting vegetation along streams.

Certainly this compilation by so many people who know what they are writing about should be widely read by everybody who is concerned with the welfare of the African environment.

D. V.-F.

EAGLES, HAWKS AND FALCONS OF THE WORLD

By Leslie Brown & Dean Amadon; 1968.
Published by Country Life Books, Great Britain. Price £15 15s. 0d.
2 boxed volumes: 945 pages, 165 plates (mostly coloured), 15 underwing plates, 94 distribution maps, 33 figures (1 of eggs coloured), 3 tables.

This long-awaited work has at last appeared, and for most people the price will be prohibitive, but with its lavish production and multitude of plates the high cost can be expected. It is apparently these plates which have caused the great delay in publication since the text was completed; to many they will be the main feature of the work, so it is unfortunate that the quality varies so much. Eleven artists are mentioned as having contributed, of vastly differing styles and accomplishments. Some of the birds are wooden and appear to have been drawn from museum skins, but some are superb—i.e. Reid Henry's *Spilornis* Serpent Eagles. The great advantage is that every species of bird of prey in the world is depicted.

The text is divided into two parts—the first 18 chapters of 150 pages are modestly called introductory by the authors. They do indeed form a succinct introduction to the raptors, but are far more than this, and provide a scholarly summary of what is known of their biology. Each fact is backed by specific examples. Part I is complete in itself and has its own index (but this is in Volume 2), and for many will justify the book on its own account.

Part II is divided into three chapters: one on field identification, one on nomenclature and taxonomy, and the greatest part of about 650 pages is the specific list, where what is known of each of the nearly 300 species considered is summarised. The taxonomic treatment is conservative, and most birds can be found under their familiar names! If they cannot, alternatives can be found listed on pages 160-163. Each chapter of Part I and each species in Part II is followed by key references, and there is also a supplementary bibliography at the end of the work arranged under chapters, systematic groups and by zoogeographic regions. These enable one to amplify the authors' necessarily brief treatment.

The account of a particular species varies in length depending on what is known about it, and so a good idea can be obtained of what has still to be learnt. The information is arranged in the following way: the bird's scientific and common names with a reference to the appropriate plate(s) and map (but no page reference to these is given); range; fairly detailed descriptions of the adult, immature and downy young etc. (if there is more than one race the typical form is described, with a mention of how the others differ); field characters; voice; general habits; food; breeding habits. Pertinent references complete each account.

These two books have been in use for some time in the library at the Museum in Nairobi, and many users complain that they cannot find the bird they want. I find that, as in any new book, one has to learn one's way around, but I do admit that for anyone who does not habitually use scientific names it can be difficult as the index is arranged under genera, and one has to know what genus the authors use. Anyway, I would suggest that the specific list on pages 163-172 will enable one to find a bird more quickly than the index, and it also gives details of plates and maps.

The bulk and weight means that this will normally remain a library reference work, nor will anybody want to spoil such handsome volumes by taking them into the field. They are extremely well-produced, but some printer's errors mar an otherwise excellent production. There is also some slack proof-reading, for instance the Augur Buzzard is referred to as *Buteo rufofuscus auguralis* on plate 7 (underwing patterns) and the caption to plate 84 only identifies 5 of the 7 figures. Incidentally, it is slow work identifying a particular figure on the plate from these outline drawings opposite.

These comments are only minor criticisms and this will obviously remain the authoritative work on the Falconiformes for a long time to come. The authors are to be congratulated for such a readable but scientifically accurate account, which caters for both the ornithologist and general reader. Any 'feather-plucking' they may have indulged in (page 13) has been well worthwhile. A. D. F–W.

A CONTRIBUTION TO THE ORNITHOLOGY OF ZAMBIA

By C. W. Benson & M. P. Stuart Irwin; 1967. *Zambia Museum Papers* No. 1: i-xiii, 1-139. Published by the Oxford University Press. Price 25/-. This series succeeds the *Occasional Papers of the Livingstone Museum.*

In his introduction the General Editor says that this series is for the "publication of minor works of serious scholarship on scientific and cultural matters relating to Zambia and to central Africa . . . . . The contributions made both directly by Mr. C. W. Benson and indirectly through those research workers he has stimulated and encouraged cannot be praised too highly." This is evident in this work where of the three pages of reference cited, one page is devoted to Benson's own published work.

This paper has notes on "some 240 selected species" and is a forerunner of *The Birds of Zambia* by the present authors and R. K. Brooke. It is mainly concerned with extensions of range in Zambia, but also has some details of breeding, migratory movements and notes on subspecific taxonomy.

Much of this is of little interest in East Africa proper, but the ecological notes on 11 species of bishopbirds and whydahs in the genus *Euplectes* would be well worth following-up here; in Zambia it has been found that the "richer and more complex the habitat, the greater the number of species. But some absences may be due to interspecific competition."

That even such a careful worker as Benson can be mistaken is shown by his identification (*Ibis* 1945:309) of a call in Abyssinia as that of Heuglin's Courser *Rhinoptilus cinctus* (and quoted as such by McLachlan & Liversidge in *Roberts' Birds of South Africa*), which is probably that of the Nubian Nightjar *Caprimulgus nubicus*. As he says it "goes to emphasize the extreme care that must be exercised in identifying the calls of nocturnal birds." He does not say what a rare bird the author is who publishes a correction of an earlier error!

The manuscript was in press for two years, which seems an inordinate delay for a relatively simple publication. It was printed in East Africa; the publishers can be pleased with the result and there are very few printing errors, but the irregular spacing between words (i.e. on pages 99, 109 etc.) is distracting and mars an otherwise competent job. The price of 25/- is rather excessive for a paper-backed publication but no serious student of African birds should ignore this paper. A. D. F-W

EAST AFRICA NATURAL HISTORY SOCIETY

NOTICE TO CONTRIBUTORS

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Errata

Jl E. Africa nat. Hist. Soc. Vol.**XXVII** No. 3 (118) January 1969;
The correct date of publication was 11/12/69, not 31/1/69.
Contents page, fifth article down, *Udotea*, not *Udotes*.
Bird Ringing Report 1967–1968.
p. 218: line 2: for J. R. Sternstalt *read* R. J. Sternstedt.
p. 218: in para. 3: for A.n. Igles *read* A. Ingles.
p. 218: Table 1: for **Paleartic Migrants** read **Palearctic Migrants in Bold Type.**
p. 222: Table 2, J. 4466:
for 7.1.68 *read* 7.1.67
p. 223: Table 3, A. 0279:
for 15.1.161 *read* 15.1.61
p. 223: Table 3, J. 1426:
for DJ *read* **DJP**
p. 224: Table 4, Hiddensee 3 571:
for 13.7.67 *read* 13.7.66
p. 231: A Nineteenth Century Reference to the Use of Tools by the Egyptian Vulture, authors R. M. Baxter *not* R. H. Baxter; and E. K. Urban *not* S. K. Urban.
1st. para 3rd line *percnopterus* not *perconopterus*
References, 3rd. line *percnopterus* not *percnonpterus*.

JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 28 7th APRIL 1971 No. 120

FRESHWATER PRAWNS OF THE GENUS *MACROBRACHIUM* (CRUSTACEA: PALAEMONIDAE) IN EAST AFRICA, WITH A KEY FOR THEIR IDENTIFICATION AND NOTES ON THEIR EXPLOITATION

By

R. G. Bailey and M. Crichton*

INTRODUCTION

During investigations of lake and reservoir fisheries in the drainage basins of the Rivers Wami and Ruvu in Tanzania, the widespread occurrence of river prawns belonging to the genus *Macrobrachium* Bate 1868, was noted (Lockley—unpublished Safari Notes nos. 53, 55 & 56, Dar es Salaam and Bailey 1966). In 1963 a study of the biology of these prawns in a small lake near Kilosa was commenced by the authors together with a collection of data on their distribution and use as food in Tanzania. In the course of this work a major problem was encountered with regard to the correct identification of collected material. Specimens were despatched to Dr. I. Gordon at the Natural History Section of the British Museum, who kindly discussed our problem and drew up a provisional key for the identification of species previously recorded in East Africa.

Since returning to the United Kingdom, the authors have been able to examine their own and other relevant material in the British Museum collections. This work, and an investigation of published accounts of the genus has enabled the compilation of a key for the identification of species of *Macrobrachium* occurring in East Africa. It is presented here for the benefit of fisheries staff and others working in the field, together with distribution data and some notes on their present exploitation.

Apart from the genus *Macrobrachium* which belongs to the family Palaemonidae, certain other genera of freshwater prawns, notably *Caridina*, are found in East Africa. The latter belong to the family Atyidae and may be readily distinguished by the unusual form of both pairs of chelate thoracic limbs, which, moreover, are little different in relative size, see *Figure I*. In *Macrobrachium* the first two pairs of pereiopods are likewise chelate, but of normal shape and markedly unequal in size.

SPECIES KEY.

Earlier keys for the identification of *Macrobrachium* in eastern and south-east Africa are given by Hilgendorf (1898) and Barnard (1950) respectively, but the following is largely based on that given by Holthius (1950) in his comprehensive account of

(* — Formerly with the Tanzanian Fisheries Division; present addresses — R. G. Bailey — Zoology Department, Chelsea College, University of London. M. Crichton — 65, Wellington Road, Ballsbridge, Dublin, Ireland).

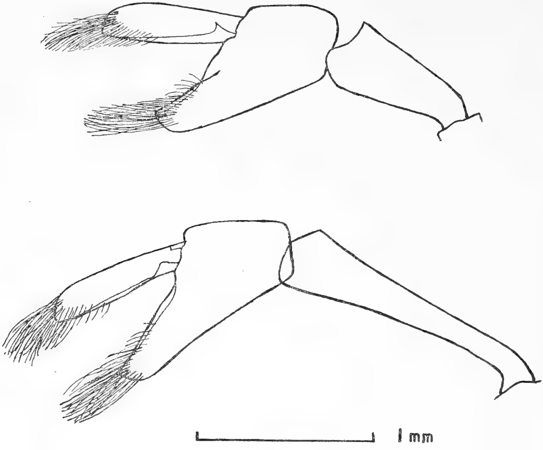

Figure I. First and second pereiopods of *Caridina nilotica*, Family Atyidae, (after Gordon 1930).

the genus in the Indo-West Pacific Region. All three authors have found that separation of the species must primarily rely on the characters of the rostrum and second pair of pereiopods of the adult male. The latter form the major chelipeds and in the adult male they become considerably elongated and enlarged, and the armature on the fingers of the chela is distinctive. In females and young males the second pereiopods are shorter and more slender, and the relative lengths of the different segments of the limb may be different from their condition in the adult male. Further, in young specimens the rostrum tends to be relatively longer and more slender.

In the following key most divisions are based on differences in the form of the second pereiopods of the adult male, and thus it is essential that complete specimens of the latter are included in collections for identification. A note on the recorded distribution of each species in Africa and the Western Indian Ocean is included in the key with additional comments on the material examined. The following abbreviations are used:— c/m—ratio of carpus to merus length; c/ch—ratio of carpus to chela length; c/p—ratio of carpus to palm length; p/f—ratio of palm to finger length and C.L.—carapace length. *Figure II* illustrates the features of the head and thorax of *Macrobrachium* used in the key, and the measurement of carapace length i.e. the distance from the posterior limit of the orbit to the posterior edge of the carapace. *In Figure III* the nomenclature of the segments of the second pereiopod is given and the form of the chela in several species is shown.

1. (a) Carpus of second pereiopod of adult male distinctly longer than merus (c/m=1.4–1.8) . . . . 2.
   (b) Carpus of second pereiopod of adult male about equal to or shorter than merus (c/m=1.1 or less) . . . . 5.
2. (a) Carpus of second pereiopod of adult male about equal to or longer than chela (palm of chela distinctly longer than fingers), *Fig. III*, 1 3.
   (b) Carpus of second pereiopod of adult male distinctly shorter than chela, (palm of chela about equal to or longer than fingers) . . 4.
3. (a) 9–11 dorsal rostral teeth, 3 of which are situated behind the posterior limit of the orbit . . . . . . *M.idae* (Heller) 1862. (Tanzania—Zanzibar, Dar es Salaam, no recent record; Seychelles and Madagascar.)
   (b) (11) 12–17 dorsal rostral teeth, usually only 2 situated behind the posterior limit of the orbit, *Fig. II* . *M.idella* (Hilgendorf) 1898. (**Tanzania**—Rivers Wami & Ruvu, dams & lakes in their catchments, Ruaha & Kilombero tributaries of River Rufiji, Lake Babati; also **Madagascar.** Holthius (1950, p. 147) commenting on the close similarity of *M.idae* and *M.idella*, notes that former has smaller ova and a larger c/ch ratio in male. All specimens examined were referred to *M.idella.* Rostrum shorter than or almost reaching apex of antennal scale. 13–16 dorsal rostral teeth, in a few cases with 3 behind posterior limit of orbit; some slight spacing of teeth towards tip. 4, infrequently 5 ventral rostral teeth. Second pereiopods of adult male—long and slender; c/ch=0.9–1.1; p/f=1.35–1.60. Fingers with 1 and 2 proximal teeth, concealed by a dense brownish coat of short hairs or setae in some specimens, see *Fig. III*, 1. All segments of limb with small tubercles and fine, scattered setae. 3rd–5th pereiopods—slender, pubescent. Carapace—smooth or minutely spinulose anterio-ventrally. C.L. of largest specimen examined—17mm.)
4. (a) Chela of second pereiopod of adult male with tubercles in 2 rows, one along either side of cutting edges of fingers. Rostrum not markedly curving upwards, just shorter than antennal scale. 3–5 ventral rostral teeth . . . . . . *M.rude* (Heller) 1862. (**Tanzania**—Rivers Sigi, Wami & Ruvu; **Zanzibar**?; **Kenya**—River Athi-Sabaki; **Somali Rep.**—River Juba; **Mozambique, South Africa** and **Madagascar.** 10–15 dorsal rostral teeth, 2 or 3 behind posterior limit of orbit. Some specimens exhibit a marked spacing of dorsal teeth towards tip of rostrum. Second pereiopods of adult male with c/ch=0.50–0.75, p/f=1.0–1.2. All segments of limb pubescent and fingers densely covered with setae in some specimens. Carapace—generally granular anteriorly. C.L. of largest specimen examined—30mm.)
   (b) Chela of second pereiopod of adult male without tubercles beyond a few proximal teeth on fingers. Rostrum usually distinctly curving upwards and reaching apex of antennal scale. (4)5—7 ventral rostral teeth . . . . *M.equidens* (Dana) 1852. (**Tanzania**—River Ruvu & **Zanzibar**; **Kenya**—Rivers Korumi & Tana; **Mozambique, South Africa** and **Madagascar.** An essentially brackish water species but extending into freshwater. 9–13 dorsal rostral teeth, 3 behind posterior limit of orbit. Second pereiopod of adult male with c/ch=0.70–0.86, p/f=1.10–1.37. All segments of limb pubescent and with small spinules. Long scattered setae on fingers. Carapace—smooth. C.L. of largest specimen examined—22mm.)

5. (a) Second pereiopods of adult male equal or subequal in shape; fingers of smaller not gaping and not provided with stiff setae . 6.
   (b) Second pereiopods of adult male very unequal in shape; fingers of smaller chela generally gaping with stiff setae, see Fig. III, 2 & 3 *M.lepidactylus* Hilgendorf 1879.
   (**Tanzania**—Rivers Pangani, Ruvu & Rufiji also **Zanzibar; Kenya**—River Athi—Sabaki; **Somali Rep.**; **Mozambique, South Africa** and **Madagascar.** Rostrum shorter than antennal scale, teeth broad and erect, 11–14 in dorsal row with 4–5 situated behind posterior limit of orbit, and 2 in ventral row. Second pereiopods of adult male strong and robust, all segments with scale-like tubercles and short scattered setae. Smaller chela with palm much shorter than fingers, p/f=0.4–0.6. Larger chela with palm broad, more or less equal to finger length. Latter with well developed teeth along cutting edges, hooked distally, see Fig. III, 3. There is a flattened ventral tooth between the bases of the uropods. This feature also found in females, which likewise have scaly pereiopods. C.L. of largest specimen examined—42mm.)
6. (a) Fingers of chela of second pereiopod of male without teeth, or with a minute proximal tubercle only. Very small species . . . . 7.
   (b) Fingers of chela of second pereiopod of adult male with distinct teeth. Relatively large species . . . . 8.
7. (a) 1 dorsal rostral tooth behind posterior limit of orbit, 1–2 ventral rostral teeth . . . . *M.niloticum* (Roux) 1833.
   (**Kenya**—Lake Rudolf; River Nile. 10–11 dorsal rostral teeth. Second pereiopod of male with carpus subequal to merus, and longer than palm of chela, c/p=1.60–1.85. Palm slightly swollen, shorter than fingers, p/f=0.53–0.60. Fingers with short scattered setae, but no teeth—may separate slightly towards their minutely hooked tips. Limb smooth. C.L. of largest specimen examined—6.5mm.)
   (b) 2–3 dorsal rostral teeth behind posterior limit of orbit, 3–5 ventral rostral teeth . . . . *M.moorei* (Calman) 1899.
   (Indigenous to **Lake Tanganyika.** 11–13 dorsal rostral teeth. Second pereiopod of male with carpus equal to merus, and longer than palm of chela, c/p=1.30–1.56. Palm shorter than fingers, p/f=0.67–0.83. Fingers straight, without teeth or with a single minute tubercle close to the base of one. Limb with short scattered setae, carpus and palm minutely spinulose. Females with 2 rounded tubercles at base of fingers were noted, see also Calman 1906. C.L. of largest specimen examined—6.3mm.)
8. (a) Fingers of chela of second pereiopod of adult male with a number of teeth on the proximal half or along the entire cutting edge (*Fig. III,* **5**). Teeth generally of equal size, but if any are slightly larger, these are always nearest base of finger . . . . 9.
   (b) Fingers of chela of second pereiopod of adult male with 1–2 relatively large teeth and smaller teeth present between the first large tooth and base of finger (*Fig. III,* 4) . . . *M.lar* (Fabricius) 1798.
   (**Tanzania—Zanzibar & Pemba**—not recorded from mainland; **Seychelles; Mauritius** and **Madagascar.** Rostrum not or just reaching apex of antennal scale, with 7–8 dorsal teeth and 2–4 ventral teeth. Second pereiopod of adult male with c/m=0.91–0.98; chela with a strikingly long palm, c/p=0.56–0.64 and p/f=1.5–1.9. Tips of fingers unevenly hooked; each with a single large tooth and one or

more smaller, rounded proximal teeth, see *Fig. III*, 4. All segments of limb granular, with ventral rows of recumbent spines; short scattered setae on fingers. A ventral tooth is present between bases of uropods. C.L. of largest specimen examined—48mm.) . .

9. (a) Chela of second pereiopod of adult male with palm and basal part of fingers covered in velvety hairs and having a woolly appearance, *Fig. III*, 5 . . . . . . *M.scabriculum* (Heller) 1862.
(**Tanzania**—Rivers Pangani, Ruvu & Rufiji, also **Zanzibar; Kenya**—Rivers Athi-Sabaki & Tana; **Somali Rep.**—River Juba; **Mozambique.** Rostrum shorter than antennal scale; 12–16 dorsal teeth with 3–5 behind posterior limit of orbit, and 2–4 ventral teeth. Second pereiopod of adult male with carpus usually equal to merus in length and equal to or longer than palm of chela. Teeth along entire cutting edges of chela, increasing slightly in size towards the base of fingers. All segments of limb with scattered hair-like setae, minutely spinulose. Carapace-granular. C.L. of largest specimen examined—29mm.)

(b) Chela of second pereiopod of adult male naked, or with a few scattered hairs . . . . . *M.patsa* (Coutiere) 1899.
(**Kenya**—Tsavo tributary of River Sabaki; **Madagascar.** No material examined.)

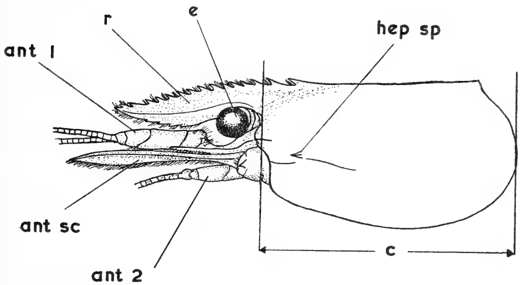

Figure II. Head and thorax of *Macrobrachium idella* (male). ant 1 - antennule, ant 2 - antenna, ant sc - antennala scale, r - rostrum (with 15 dorsal teeth are 2 of which, situated behind the posterior limit of the orbit, and 4 ventral teeth), e - eye, hep sp - hepatic spine and c - carapace length (17mm. in specimen drawn).

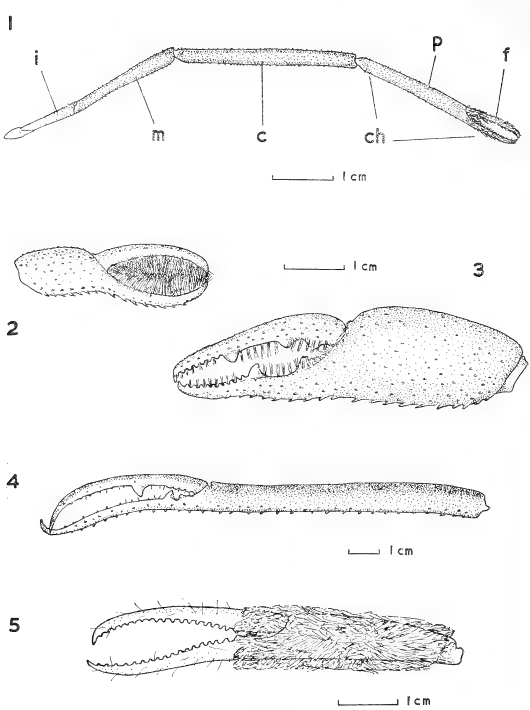

Figure III, 1 - second pereiopod of adult male of *Macrobrachium idella* (Caparace Length - 17mm.),
i - ischium, m - merus, c - carpus, - ch. - chela, p - palm, f - fingers.
2 - small chela and 3 - large chela of adult male of *M. lepidactylus*. (C.L. - 32.8mm.).
4 chela of adult male of *M.lar* (C.L. - 48mm.).
5 - chela of adult male of *M.scabriculum* (C.L. - 29mm.).

NOTES ON THE EXPLOITATION OF MACROBRACHIUM IN EAST AFRICA.

Tanzania

To obtain information on the utilization of freshwater prawns a questionnaire was circulated to Fisheries Staff in various localities. With few exceptions nil returns were received. This, together with the authors' observations in the field and at fish markets suggests that at present freshwater prawns have little commercial importance, although they may be exploited locally in a few places, where they are easily caught in large numbers.

On the lower Rufiji *Macrobrachium* is recorded from basket traps in parts of the main river and from seining in seasonal flood pools and lagoons. The catch may be offered for sale in local markets. *Macrobrachium lepidactylus* and *M. scabriculum* are two species recorded in this area and *M.rude* has been noted in the fish market at Dar es Salaam to the north. However, in the coastal region the principal interest lies with the marine penaeid prawns, for which there is an important fishery notably around the Rufiji delta.

Further inland, *Macrobrachium idella* and less commonly *M.rude*, are occasionally caught by villagers employing short lengths of cloth as improvised seines in the marginal shallows of lakes and dams in the Wami and Ruvu basins. The catch is primarily for home consumption but evidence of a slight commercial interest has been noted. At Kidete on the Central Railway, cooked prawns from Lake Gombo are offered for sale to train passengers, and at Hombolo Reservoir where prawns from the River Wami were introduced by Fisheries Staff, the catch is reported to have a limited outlet among a section of the community in nearby Dodoma. Unlike the coastal region, however, prawns are not generally acceptable as food in these more central areas, but wherever possible encouragement is and should be given to a wider development of the habit of taking catches for domestic use since, suitably cooked and flavoured, they can provide a useful 'relish' accompaniment to staple foods. It was largely with this in mind, that stocking trials with *M.idella* in small ponds near the Central Agricultural Research Centre at Kilosa were carried out. These were successful in that prawns thrived and egg-carrying females were observed throughout the year. (An account of the biology of these prawns in a small lake is in preparation.)

Kenya

Whitehead (1960) comments that while *Macrobrachium lepidactylus*, *M.scabriculum* and *M.rude* make a significant contribution to basket trap catches on the lower Sabaki River, they have only a small and fluctuating commercial value. The former is the largest (up to 40gm.) but less commonly caught species.

Attempts to culture *M.lepidactylus* taken from this river, have been made by the Fisheries Department at the Sagana Fish Culture Farm. The prawns, which were provided with cover and fed regularly on chopped *Tilapia* meat, survived in pond conditions, but at no time was there any indication of breeding (Kenya Fisheries Dept. Annual Reports 1960–62).

Apart from the instances given above no other recent attempts to culture species of *Macrobrachium* are recorded in East Africa, although it is interesting to note that the possibilities of freshwater Crustacea were explored in Uganda with the limited introduction in 1963 of the American crayfish *Procambarus clarkii* for pond culture.

Elsewhere considerable success has been achieved in the culture of species of *Macrobrachium*. For example in Florida *M.acanthurus* and *M.carcinus* are cultivated artificially and considered to be of commercial value (Ingle & Eldred 1960) and in parts of the Indo-Pacific Region young prawns of the large brackish water form *M.rosenbergi* are grown in ponds and irrigated rice fields in combination with non-carnivorous fish (Ling & Merican 1962).

ACKNOWLEDGEMENT

We wish to acknowledge our gratitude to Dr. Isabella Gordon of the Crustacea Section of the British Museum (Natural History), for her early advice and helpful criticism of the manuscript.

LIST OF MATERIAL IN THE BRITISH MUSEUM EXAMINED

Species	Brit.Mus.Reg.No.	Locality
M.idella	unregistered	Lake near Kilosa, R.Wami, **Tanzania**
M.rude	1951.4.16.1–6	Sabaki & Tana Rivers, **Kenya**
	1955.1.24.1–7	R.Sabaki
	1962.9.18.13	R.Sabaki
	1964.7.10.50–53	Dar es Salaam, **Tanzania**
	unregistered	Durban Museum, **South Africa**
M.equidens	1962.9.18.14	R.Korumi, **Kenya**
	unregistered	**Singapore & Solomon Islands**
M.lepidactylus	1915.11.12.1–3	Tributaries of R.Athi, **Kenya**
	1955.1.24.9	R.Sabaki
	1967.105.1–2	R.Sigi, **Tanzania**
	unregistered	R.Pangani, **Tanzania**
M.niloticum	1906.6.1.1–2	White Nile
	1934.2.8.30–139	Lake Rudolf, **Kenya**
M.moorei	1906.2.12.1–10	**L.Tanganyika**
M.lar	1928.9.24.1–3	R.ChemChem, **Zanzibar**
	unregistered	**Seychelles**
M.scabriculum	1914.6.1.6–19	**Madagascar**
	1951.4.16.7–20	Sabaki & Tana Rivers, **Kenya**
	1955.1.24.10–12	R.Sabaki
	1962.9.18.15	R.Sabaki

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(Received 19th January, 1970).

Printed by Kenya Litho Ltd., P.O. Box 775, Nairobi

JOURNAL
OF THE EAST AFRICA NATURAL HISTORY
SOCIETY AND NATIONAL MUSEUM

VOL. 28 7th APRIL 1971 No. 121

PARORCHIS AVITUS (Linton 1914)

Apollo H. Ogambo-Ongoma* and Albert G. Canaris.
Laboratory of Parasitology,
Department of Animal Science and Production,
Makerere University Kampala, Uganda. And
Department of Zoology, University of Montana,
Missoula, Montana, U.S.A.

The morphology of *Parorchis avitus* was described by Linton in 1914. Further study on the morphology of this species was done by Stunkard and Cable in 1932. Findings of these two workers confirmed Linton's descriptions and in addition revealed more information such as length, width of pharynx, and width of acetabulum.

On July, 7th 1965, two specimens of *P. avitus* were recovered from the intestine of *Tringa hypoleucos* in Kenya. The trematodes were fixed in A.F.A., stained in Delafield's Hematoxylin and mounted in permount. The study of these specimens showed their similarity to those specimens studied by Stunkard and Cable in 1932. The average measurements in Microns of the two specimens studied are: length 3,410; width, at the widest region just posterior to the acetabulum, 1,914; oral sucker 393×383; acetabulum 908×908; right testis 315×307; ovary 225×208; egg 70×39. A collar occurs around the oral sucker; the collar is more prominently spined on the ventral side. Cuticle spined, spines being more intensive in the region between the anterior extremity and the acetabulum. The spines become more and more sparce as one approaches the posterior end.

DISCUSSION

Our specimens have everything else in common with *Parorchis avitus* except for the measurements. The other related species is *P. snipis* described from *Totanus hypoleucos* by Lal in 1936; however, *P. snipis* differs in having a shorter aesophagus, and complete lack of spines on the posterior end. Intestinal caece are relatively straight as compared to those of our specimens, which are more convoluted; and complete lack of recurrent excretory tubercle. Stunkard and Cable's specimens of *P. avitus* have average measurements of length 1,800 compared to ours of 3,410; oral sucker 236 wide as compared to ours of 390×383; acetabulum 433 wide as compared to ours of 908×908; pharynx 100 wide as compared to ours of 214×165.

Since the characteristics of *P. avitus* as described by Stunkard and Cable fit in well with those of our specimens, and since Stunkard and Cable's do not show any evidence of eggs being present we think that specimens studied by the two workers (15 days old) were not mature enough, and therefore, did not attain full growth. Present evidence as brought out by our study shows that *P. avitus* is a much larger species than Stunkard and Cable have shown.

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*This work is in partial fulfillment for the degree of Master of Science in the Department of Biology, West Virginia University, Morgantown, W. Va. U.S.A.

RECEIVED 14th SEPTEMBER 1970

JOURNAL OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 28 | 15th MAY 1971 | No. 122

MARINE BOTANY OF THE KENYA COAST

5. A Third List of Kenya Marine Algae

By

WM. EDWYN ISAAC*

University College, Nairobi

ACKNOWLEDGEMENTS

The work recorded in this fifth paper in the series on the Marine Botany of the Kenya coast was made possible chiefly by the financial support of the Rockefeller Foundation whom I wish to thank for their generosity.

During my visit to Australia in 1968 I received help from a number of marine phycologists including A. B. Cribb and Mrs. Sophie Ducker for which help I wish to offer my thanks. Thanks are also due to Professor Robertson of Adelaide University, Professor Turner of Melbourne University and the Curator of the National Herbarium Melbourne and his staff for providing space and facilities for my work. Especial thanks are due to Dr. Bryan Womersley and his phycological colleagues at Adelaide University for the considerable help given me in discussion, identification of specimens and the provision of photostat copies of relevant parts of phycological works not obtainable in East Africa. I look back with considerable pleasure to the profitable and enjoyable time, all too short, which I spent in the Botany Department of Adelaide University.

Many other phycologists have generously helped me by naming algal specimens and to these I tender my thanks. Specific acknowledgement is made in the appropriate places in the sequel. Special mention must be made in this connection of Dr. William Johansen and Dr. W. H. Adey.

I wish to thank J. B. Gillett of the E. A. Herbarium for steering the paper through the press after my retirement to Australia.

Lastly but by no means least, my thanks are due to my wife, Mrs. Frances M. Isaac, for the considerable help she has given me in collecting, mounting, correspondence, preparations for the identification of specimens and in drawing the figures and maps for this paper.

*Present Address: Flat 4, 35 Clyde St., East Kew, Victoria 3102, Australia.

INTRODUCTION

This paper has been written on the eve of leaving Nairobi on retirement. Hence more items have been recorded without further delay than would otherwise have been the case, in the hope that these records will be of value to other East African botanists.

Literature cited has been of publications available to me in Nairobi or consulted during my visit to Australia or made available in Adelaide as photostat copies.

The specimens which have been collected in the course of investigations reported in this series of papers are housed in the Botany Department Herbarium, University of Nairobi and the East African Herbarium Nairobi except for certain specimens which will be retained for the present by the author for further possible investigations. A number of specimens will also be housed in the Botany Department University of Adelaide.

As well as a map of the Kenya Coast indicating localities cited (Map 1), a detailed map of the Diani region has been included since much of the collecting for these papers has been done there. The names on this map are frequently used on the labels on herbarium specimens and may be of service to future collectors. (Map 2).

CYANOPHYTA

Lyngbya majuscula (Dillw.) Harv. ex Kuetz., was recorded in the second list of Kenya marine algae (Isaac, 1968). The specimens concerned have been re-named by Drouate (1968) as *Microcoleus lyngbyaceus* (Kuetz.) Crouan. It is included in the list below under this name.

The few genera collected are arranged alphabetically. The numbers cited except for some of those for *Microcoleus lyngbyaceus* were determined or confirmed by Drouet. The other numbers for this species were determined or confirmed by Dr. Josephine Koster.

Anacystis aeruginosa (Zanard.) Drouet et Daily.
4272. Diani.

Hormothamnium enteromorphoides Grun.
4529. (With some *Microcoleus lyngbyaceus*) 4530. Diani.

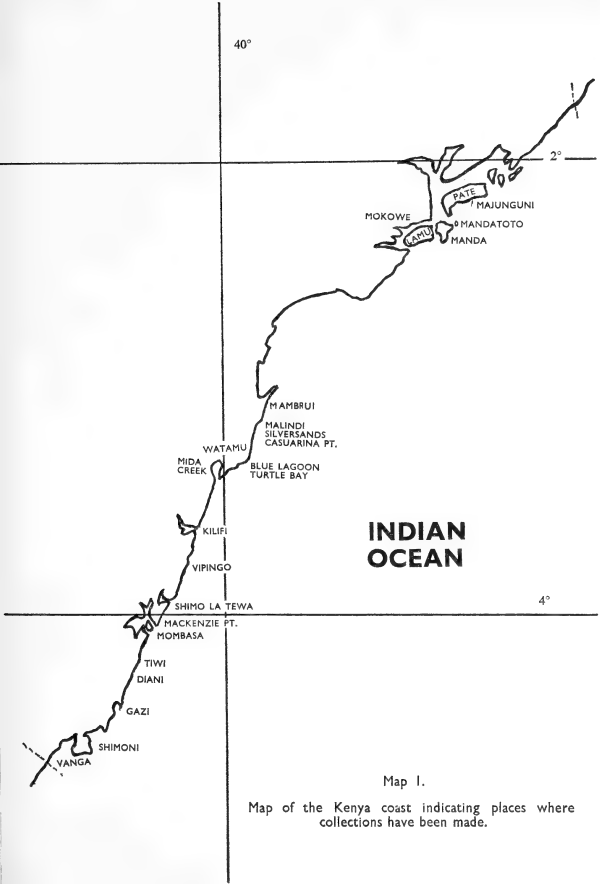
Microcoleus lyngbyaceus (Kuetz.) Crouan
2679, Gazi.
3812, Malindi Casuarina Point.
4373, 4524, 4525, Diani, (the last two with *Schizothriz calcicola*)
4528, 4531, 4684, 4685, Diani; 4684 (with *Schizothrix mexicana.*).

Additional records.
2506. Diani.
2711. Mida Creek.
3220. Mokowe, Lamu Distr. Mangrove Mud flats.
3293. Majunguni, Lamu Distr.
3294. Pate Island, Lamu Distr. Very common epiphyte on *Cymodocea ciliata.*
3832. Mambrui.

Oscillatoria submembranacea Ard. & Straff.
3821, Malindi, Casuarina Point.
4553 (with *Schizothrix calcicola.*), 4658, Diani.

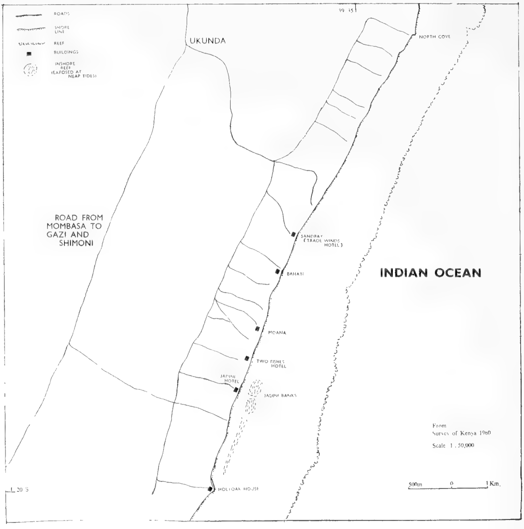
Schizothrix calcicola (Ag.) Gom.
4525, Diani (with *Microcoleus lyngbyaceus*)
4683, Gazi.

S. mexicana Gom.
3909, Malindi, Silversands.
4353, 4684, Diani (latter with some *Microcoleus lyngbyaceus*).



Map 1.

Map of the Kenya coast indicating places where collections have been made.



Map 2.
Map of the Diani area
Diani Beach is generally regarded as extending from North Cove to the point below Holyoak House

CHLOROPHYCEAE

Ulotrichales

Ulva spp.

Two reticulate species of *Ulva* occur abundantly on south and central Kenya coasts. One of these is *U. reticulata* Forsk. . Material of the other species has been shown or sent to a number of phycologists including A. B. Cribb, Papenfuss and Womersley and the available literature has been carefully examined but the taxon has not been recognised as a known species and no description has been found corresponding to this East African alga. The probability would seem to be that this plant is an undescribed species.

As compared with *U. reticulata* it is of a lighter green colour; of flimsy, soft consistency; spreads out into a greater or lesser number of more or less fan shaped parts (Fig. 3); has squarer less elongated cells (Fig. 4); is more regularly fenestrated, the fenestrata decreasing in size towards the periphery (compare Pl. 1 Figs. 1 & 3).

It is a beautiful silky soft plant lacking the firm consistency of *U. reticulata* and the outer tangential walls of the cells are not as thick as those of *U. reticulata*. (Pl. 1 Fig. 2). Because of the spreading fan-like nature of the segments of this plant it lacks the wholly elongated appearance of *U. reticulata*. There are narrow irregular elongated portions linking the fan-like sections. These 'fans' have an outer border which is non-fenestrated or with few minute scattered fenestrations.

The two reticulate species occur epiphytically entwined and entangled with other algal species both in pools and on rock surfaces decreasingly from about mid-tide level downwards. They are often intermingled.

Ulva reticulata Forsk.
3519 Diani 5.7.67
3815 Malindi 1.12.67
4420 Diani 15.4.68
4498 Diani 30.11.68

Ulva sp.
2922 Shimo la Tewa 10.12.65
3492 Diani 30.6.67
3510 Diani 4.7.67
4398 Diani 13.4.68
4422 Diani 15.4.68
4486 Tiwi 29.11.68

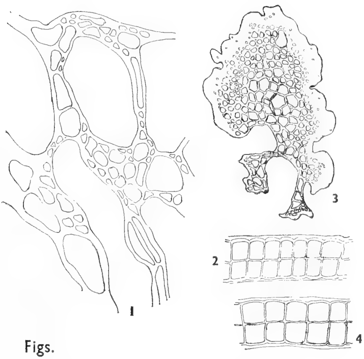


Plate I

Figs.

1. Ulva reticulata part of plant, half natural size.
2. ,, ,, section of thallus x 160
3. Ulva sp. part of plant, half natural size.
4. ,, ,, section of thallus x 160

SIPHONALES

Avrainvillea capituliformis Tanaka

Tanaka, T., 1967, pp. 14–16, Plate 1.

The numbers listed below were investigated by Dr. Womersley who considered them to correspond to this species as described by Tanaka. Womersley, however, is inclined to the view that this taxon is best regarded as a loosely tufted form of *A. erecta*. As these specimens are of very distinctive appearance in the field they are tentatively here included under *A. capituliformis*.

1724. Turtle Bay. Aug. 1961.
2968. Malindi, deep pool below the Vasco da Gama padrao. 4.4.66.
3384. Turtle Bay. 5.4.67.
3992. Mombasa, Mackenzie Point. 8.12.65.

Bryopsis pennata Lamour. var. *leprieurii* (Kuetz.) Collins & Hervey

Identification confirmed by Durairatnam.

Taylor 1960, p. 132 characterises this variety as having few, short branchlets, sometimes unilateral and in discontinuous series, the axis in between being naked.

One collection of identified and confirmed material:

3346, Turtle Bay Watamu District.

Agrees with Bermuda material in Botany Department Herbarium, Melbourne (ex. Herb. Bernatowicz).

While only one collection was made of this variety, *B. pennata* (previously recorded: Isaac, 1967) was collected in four localities at intervals over the greater length of the Kenya coast, as follows:—

2421, Manda Island, Kitau: Lamu region.
3077, 4721, Malindi, near and at base of the Vasco da Gama padrao.
2537, 4715, Tiwi.
3990, Mombasa, Mackenzie Point.

Chlorodesmis fastigiata (C. Ag.) Ducker

Previously known as *Vaucheria fastigiata* C. Ag. and *Chlorodesmis comosa* Harvey & Bailey.

For discussion of nomenclature see Ducker, 1969 and for an account of the plant as *C. comosa* see Ducker, 1967.

3257, Lamu district, Manda Kitau. Det. Ducker.

C. hildebrandtii A. & E. S. Gepp

Ducker, 1967, p. 164.

2962, Diani
3327 Lamu region: Ras Takwa, Manda Island.
3421, Watamu, Turtle Bay.

All determined by Ducker.

C. major Zanard.

Ducker, 1967, p. 167.

3566, Diani
3830, Mambrui.

Both determinations by Ducker.

C. caespitosa was recorded in the first list of Kenya marine algae (Isaac. 1967) but for the sake of completeness the numbers and localities are given below, All of these numbers except 3599 and 4418 were either determined or confirmed by Ducker.

2497, 2682, 3599, 4418: Diani.
2973, Malindi, below Vasco da Gama padrao.
3005, 3363, 3403; Watamu, Turtle Bay.

On the Kenya coast *Chlorodesmis* is much more abundant during certain times of year than at others. Material has been collected in early December, late March, first half of April, late July and in August. In part, these records reflect the times of year during which visits have been made to the coast but this is not entirely the case as frequent visits have been made in later December and in January and at best very little *Chlorodesmis* has been found during this time of year. The matter needs careful investigation but on the basis of existing records the indications are that these plants are most common during the periods of higher sea temperatures with the lower spring tides occurring during hours of darkness and absent or scarce during periods of lower temperatures and lower spring tides during daylight hours. (For discussion of sea temperatures and tides on Kenya coast see Isaac & Isaac, 1968).

It is a pleasure to record acknowledgement to my former student Miss S. Moorjani for making the measurements included below in dealing with *Codium* specimens.

Codium extricatum Silva

Silva: 1959, pp. 145–147. Plates XIII and XIV.

1996. Diani Beach 15.3.65. Small plant, about $1\frac{1}{2}$ cm. high. General morphology agrees with Silva's diagnosis.

Utricles cylindrical to slightly clavate with slightly rounded to rounded apices and separate out individually. Utricles 490 μ—584.6 μ long x 79—142 μ; wall 1.5 μ; apex 4–6.8 μ.

Hairs 35–70 μ. below apex.

Medullary filaments, 24 - 32 μ diameter.

The anatomical features fall within the range given by Silva except that the utricle wall is thinner.

2555. Tiwi. 1.8.65. Plant small, about 1.5 cm. high but showing a tendency to flattening throughout.

Utricles sub-cylindrical to clavate and separating out individually; 395–727 μ long x 63.2–189.6 μ diameter; wall 1.5 μ thick and apex 4–8 μ.

Hairs 48–80 μ below apex.

Medullary filaments, 20–32 μ diameter.

Two deviations from Silva's account may be noted:

a) wall of utricle thin, b) lowest diameter of utricle below Silva's lowest limit.

2708. Watamu, Turtle Bay. 26.8.65.

About 2 cms. high with a tendency to general flattening. Utricles, 537.2–632 μ long by 140–205.4 μ broad;

Wall 1.5 μ, 4–10 μ at apices which are sometimes lamellate.

Hairs, 60–90 μ below apex.

Medullary filaments, 24–32 μ diameter.

Good agreement except for thickness of utricle wall.

2793. Watamu, platform between Turtle Bay and Blue Lagoon. 27.8.65.

Plant about 5 cm. high.

Utricles, cylindrical to slightly clavate and dissecting out individually; 342.4–584 μ long and (79)—126–300 μ diameter, wall 1.5 μ and apex 4–8 μ.

Hairs, 20–60 μ below apex.

Medullary filaments, 24–32 μ diameter.

Apart from the thin utricle wall the chief deviations being one utricle with a diameter of 79 μ the lower limit given by Silva being 88 μ and hairs occurring 20–60 μ below utricle apex while Silva gives 40 μ as upper limit below apex.

3190. Diani, 17.3.65.

Up to 7 cms. high.

Utricles sub-cylindrical and separating out individually; 553–584.6 μ long and apart from one with a diameter of 63.2 μ, a diameter range of 94.8–158.0 μ; wall 1.5–2 μ thick, apex 3–12 μ.
Hairs, 32–80 μ from utricle apex (cf. Silva's upper limit of 40 μ.).

Codium pocockiae Silva, Approx.
Silva: 1959, pp. 138–140. Plate XII, v.; Fig. 14.

2554. Tiwi, 1.8.65.
A small plant about 2.5 cm. high. The general morphology and the character of the utricles are in agreement with Silva's account except that the utricles are shorter—110.6–126.4 μ diameter by 410.8–616.2 μ long. The dimensions for utricle wall thickness, placement of hairs from utricle apex and diameter of medullary filaments are within the range given by Silva.

2557. Tiwi, 1.8.65.
Small plants up to 3.5 cm. high. This number is tentatively included under *C. pocockiae* with misgivings. The general morphology of the plant, the separation into individual utricles, the diameter dimensions of utricle wall and medullary filament agree with Silva's description. The utricle size, however, shows a divergence: 94.8–173.8 μ diameter x 426.6–616 μ long. Further, the placement of hairs from the apex is 20–56 μ as compared with Silva's range of 50–105 μ. and most of the utricles show a slight although distinct constriction 128–158 μ below apex. No asymmetrical lamellate thickening of the apex was observed.

Halimeda renschii Hauck
De Toni, Vol. 1., 1889, p. 525.
As *H. opuntia* Lam, forma *renschii*
Barton: 1901, p. 21.
Hillis, 1959, p. 360. Here *H. opuntia* f. *renschii* (Hauck) Barton, is included under *H. opuntia* (Linn.) Lamour. var. *opuntia*. Dr. Llewellya Hillis Colinvaux intends publishing a note reviving the old species *H. renschii* Hauck (Private communication).

A number of specimen of this taxon were collected on the Kenya coast and in the Seychelles.

It was observed when collecting these plants that they differ from what is usually considered as *H. opuntia* in that there is a marked basal concentration and a fanning out upwards. The holdfasts are often not easy to see as the basal parts are so closely massed together. The plants form dense masses largely or mostly above substratum level. A number of specimens were examined by Womersley at Adelaide who reported as follows: " . . . . distinct holdfast region, erect fronds branched in one plane except near the base, densely tufted. Segments flat, small. Outer cortical utricles small (12–20 μ across in surface view), secondary utricles small, not inflated; surface utricles polygonal, remaining attached. Nodal filaments in pairs (3 or 4) attached for a short distance, tendency to form a loose and easily broken plate."

After further discussion it was agreed that the material should be submitted to Colinvaux who replied: "Your material I feel is the old species *H. renschii* . . . ."

2130, Diani, 19/3/65.
2786, Watamu, Turtle Bay. 27.8.65.
3015, ,, ,, ,, 6.4.66.
3063, Diani, 17.3.65.
3193. ,, 27.12.66.

Siphonocladales

Boodlea montagnei (Harv. ex J. E. Gray) Egerod

Egerod, Lois E., 1952, p. 332 (footnote).

Setchell, "The genus *Microdictyon*", 1929, pp. 573–580 as *Microdictyon montagnei* Harv.

Only a few collections of this species were made on the Kenya coast.

2370. Mokowe, Lamu District. Mud flats to seaward of mangroves. 30.6.65.

4492, 4493. Tiwi. 29.11.68 } Common in pools close inshore on dead reef.
4569. „ 22.12.68 }

Spongiose to a greater or lesser degree, especially Tiwi plants. 4.5 to 11.0 cm. across. Meshes of net mostly square to oblong, branches arising at right angles to axis and opposite. The connecting tenacula (cells with more or less frilly margins) evident especially in Tiwi material.

Spongocladia vaucheriaeformis Areschoug.

Okamura, K., *Icones*, **5**, 1928, pp. 189–90. pl. 250, fig. 5–12.

Gerloff, J., 1960, pp. 612–614.

Boergesen, 1946, p. 17; 1948, pp. 23–24 under heading "A Note on *Cladophoropsis*"

Sub-nom, *Cladophoropsis vaucheriiformis*

Cribb, A. B., 1960, pp. 11–12.

Papenfuss after a review of the evidence considered *Spongocladia* and *Cladophoropsis* to be congeneric and he considered that it would be advantageous to reject *Spongocladia* in favour of *Cladophoropsis* (Papenfuss, 1950).

The Kenya plants of this species living symbiotically with a sponge are so distinctive in appearance as compared with other Kenya *Cladophoropsis* that the generic name *Spongocladia* is retained.

Gerloff states that the sponge is probably *Halichondria* and he reviews the evidence for the taxonomic nature of the algal partner but without coming to a definite conclusion which he considers will only be possible by means of cultures without the presence of the sponge. (Gerloff, 1960). Boergesen also discusses the nature of the algal constituent and while not excluding the possibility that more than one taxon may be involved, he favours the view that the alga is *Cladophoropsis*.

This is a widespread plant on the Kenya coast, growing at lower intertidal levels near the reef edge. It forms large expanses of dull green colour, often 15 cm. or more in diameter and of a tough consistency. Both flat surface forms and forms with a larger or smaller number of finger like upright processes occur.

4471. Diani. 31.3.68. Mostly flat with smaller finger like upright growth.
4472. „ „ More numerous and larger upright processes.
4473. „ „ Flat spreading growth, no prominent erect processes.
4521. „ 2.12.68.
4522. Tiwi. 29.11.68.
4537, 4538. Diani. 19.12.68
4788. „ 16.12.67
4789. Mombasa, McKenzie Pt. 8.12.65.
4790. Diani, 20.12.68.

Coll. P. J. Greenway 9337. (East African Herbarium, Nairobi).
det. Gerloff.
Takawanda, Pate Island 10.10.57.
Max. diameter 14.5 cm. Plate like with some lacunae away from margins and with small upright growths.

Valonia fastigiata Harv. ex J. Ag.

Dawson, 1957, p. 101, Fig. 1.

Egerod, 1952, p. 348.

Egerod deals with this species in her section on *V. aegagropila* in which she indicates that *V. fastigiata* is a much more robust and larger plant with more uniformly cylindrical vesicles and more regularly branched.

One collection was made of this species.

3827. Mambrui, 2.12.67. Identified by A. B. Cribb.

2–3 cms. high and vesicles up to about 0.5 cm diameter.

This species is common in places on Mafia Island, Tanzania where it was found in large clumps in quiet waters often shaded by overhangs.

Dasycladales

Acetabularia clavata Yamada.

A. exigua Solms—Laubach.

A. moebii Solms—Laubach.

Moorjani, S. A., "Notes on Kenya *Acetabularia* Lamouroux" *Jl. E. Africa nat. Hist. Soc. Vol. 28*, No. 1 (119), pp. 47-52

These species are merely noted here as details will be found in Miss Moorjani's paper. The plants were cultured in the Botany Department, Nairobi from material collected at Diani.

PHAEOPHYTA

Dictyotales

Dictyota dichotoma var. *intricata* (Ag.) Grev.

Cribb, A. B., 1954, p. 20, Plate 3, fig. 4.

The specimens collected agree well with Cribb's figure and with South African plants of this taxon except that the Kenya plants collected are longer.

Papenfuss (1944) points out that this plant is usually named *D. dichotoma* var. *implexa* but he presents evidence that the correct name should be var. *intricata* (Ag.) Grev..

3292. Majunguni, Pate Island. 28.3.67. Epiphytic on *Cymodocea ciliata.*

3373. Manda Kitau. 27.3.67. Epiphytic on *Sargassum binderi.*

These plants up to about 23 cm. long; twisted to a greater or lesser extent; width usually about 1 mm.

Stoechospermum marginatum (Ag.) Kuetz. Included in list I of Kenya marine algae. (Isaac, 1967).

Among the specimens from the Kenya coast were a number of smaller, broader plants, broadening out to the apex of each branch to a greater extent than in most of the other specimens of *Stoechospermum* collected. These characteristics give the plants a distinctive appearance. They correspond to plants in the Melbourne National Herbarium which are named *S. patens* Hering. This plant is included by De Toni under *S. marginatum.* (De Toni, 3 1895, p. 251). Zanard. 1858, p. 247 also includes *S. patens* under *S. marginatum.*

2912, Mombasa, Mackenzie Pt. 8.12.65.

3843, Mambrui, 2.12.67.

Typical form—

2403. Kitau, Manda Island. 2.7.65. Tetrasporic.

2442. Manda Toto Island. 4.7.65. (Fertile, cast up, epiphytic on *Cymodocea ciliata.*)

2768. Watamu 28.8.65. Tetrasporic.

2912. Mombasa, Mackenzie Pt. 8.12.65. Tetrasporic.
3611. Diani, 20.8.67. Tetrasporic.
3844. Mambrui, 2.12.67. „
4709. Diani, 1.8.69. „

Punctariales

Rosenvingea intricata (J. Ag.) Boergesen
Cribb, A. B., 1954, pp. 23–24, Pl. 2, fig. 4.
Kuet., 1859, Vol. **9,** Pl. 5, Fig. 1. (as *Encoelium intricatum*).
Further references will be found in Cribb's paper.
2796. Watamu. 28.8.65.

Small plants, up to about 3.5 cm. and a flattened width of up to about 3 mm. The plant shows a dense branching growth similar to that reportedly shown by Queensland plants (Cribb, 1954, p. 24) and illustrated for Gulf of California plants by Dawson (1944, Pl. 52. 1). This compact type of growth contrasts with the laxer branching illustrated by Taylor (1942, Pl. 10, Fig. 2.).

Fucales

Sargassum. This genus is an ubiquitous and prominent feature of the Kenya coast, the plants occurring mostly in large pools and channels from about mid-tide level seawards; and at and beyond low tide levels of spring tides.

There are many taxa and at least some of these clearly show considerable variation. The range of variation, the absence in Kenya of collections of named species, the paucity of relevant literature and the limited time available to me have made it impossible to give a reasonably complete list of Kenya species of this important genus.

Sargassum duplicatum J. Ag. and *S. latifolium* (Turn.) C. Agr., were included in my first list of Kenya marine algae (Isaac, 1967). A few more species are listed below.
S. binderi Sond.
Durairatnam, 1961, p. 45.

Plants relatively small. Maximum length of plants collected 52 cm. but most plants less than 30 cm. Erect branches arise from a very short main axis; branch axes are flat or compressed with distichously arranged leaves; vesicles borne on flattened leaf like stalks; receptacles axillary on flat branches with warty, denticulate margins; aggregated in dense cymes.

2415. Manda Island. 2.7.65.
2762. Watamu. 28.8.65.
2950. Diani. 28.12.65.
2984, 2985, 2986, 3023, 3025, Watamu. 4th. and 7th. April 1966.
3028. Watamu. 7.4.66. Identification confirmed by Durairatnam.
3555. Diani, outer reef. 10.8.67. Identification confirmed by Durairatnam.
4342. Malindi, Silversands. 4.12.67. In pool.
4346. Malindi, Casuarina Point 1.12.67. Identification confirmed by Durairatnam.
Note: the leaves of this specimen are broader than in nearly all the specimens included under this name in the Melbourne National Herbarium including the Sonder material.
4351. Malindi, Casuarina Point. 1.12.67. A narrow leaf form.

S. ilicifolium (Turn.) Ag..
Turner, 1808, 1. pp. 113–114, Pl. 51. as *Fucus ilicifolius*.
Kuetzing, 1861, XI, t.46. I as *Carpacanthus iliciolius*. var. *venusta* Grun. (?), Boergesen, 1933a., p. 14, Pl. 4.

The Kenya plants of this species collected showed a range of variation but on the whole there was good agreement with the illustrated account given by Turner. Some longer leaved plants showed at least a fair approximation to var. *venusta*.

2982. Watamu. 5.4.66.
3024, 3027, 3394. Watamu. 7.4.66.
4275. Diani. 19.12.67.
4348, 4350. Malindi, Silversands 3rd and 4th. 12.67.
4431, Diani. 4.4.68.
4561, 4562. Diani. 20.12.68.

S. polycystum C. Ag.

Durairatnam, 1961, p. 46.

Agardh, J. G., 1889, p. 119. *sub nom. S. brevifolium* Grev. 1849, pp. 108–109, Pl. 4.

The production of numerous creeping stolons, numerous small vesicles with prominent pores and small to moderate sized leaves on long thin branches are characteristic features. The degree of murication varies and is described by Durairatnam as giving the plant a "muricated appearance" and as "somewhat muricate" by Greville. Some plants would seem to be free or almost free of murications while parts of other specimens are heavily muricated.

2306. Diani. 13.6.65. Murications prominent in parts.
2414. Kitau, Manda Island. 2.7.65. Somewhat elongated leaves, moderate murications.
2458. Manda Toto Island 4.7.65. Elongated leaves, murications not a prominent feature.

S. swartzii (Turn.) Ag.

Durairatnam, 1961, P. 44.

Sub-nom. Fucus swartzii, Turner, 1819, Vol. **4.** pp. 120–121, p. 248.

A stiff, upright plant with frequent bifurcating leaves the margins of which are entire or dentate. Most of the Kenya plants collected had few or no vesicles and were in general vegetative only.

Mostly dark coloured plants becoming almost black on drying.

Durairatnam includes *S. acutifolium* Grev. in this species and certainly plants were collected with very narrow and terete leaves as illustrated by Greville for *S. acutifolium* (Greville, 1849, Pl. 10).

1986, 2244. Diani Beach. 1.1.65.
3184. Watamu, Turtle Bay. 5.4.66.
4349. Malindi, Silversands reef. 3.12.67.
2457. Manda Toto Island. 4.7.65. Many vesicles.
2766. Watamu, headland between Turtle Bay and Blue Lagoon. 27.8.65. Det. M. Durairatnam.
2823, 2865. Watamu. 27th and 28th. Aug. 1965.
4406, 4407, 4450, 4451, 4455. Diani, outer reef. 14.4.68.

S. wightii. Grev.

Greville, 1849, p. 217, Pl. 9.

Durairatnam, 1961, p. 43.

Boergesen, 1933a., pp. 13–14.

Only a few plants of this species were collected and the identification is regarded as tentative.

2456. Manda Toto Island, 4.7.65. The identification was suggested by Durairatnam.
4386. Diani, cast up. 4.4.68. A very narrow leaf form.

RHODOPHYTA

Nemalionales

Galaxaura breviarticulata Kjellm.

Boergesen, 1942, pp. 54–56, Fig. 26; 1957, p. 8.

Some plants have longer and/or broader segments than the dimensions given by Boergesen.

2696 Diani. 13.8.65.

3824. Malindi—Casuarina Point. 1.12.67.

3983. Watamu District, Turtle Bay. Aug. 1961.

4516. Diani. 2.12.68. Segments broad.

4725. Malindi—Casuarina Point. 3.8.69.

G. cylindrica (Ell. & Sol.) Lamour.

Chou, 1947, pp. 5–7, Pl. 8, Fig. 1.

See under *G. oblongata.*

4515. Diani Beach, pools in outer reef. 2.12.68.

G. filamentosa Chou

Svedelius, 1953, pp. 33–38; Figs. 29, 30, 33.

Only a few plants were collected. In view of Svedelius' account of geographical distribution this was perhaps an unexpected record for the Kenya coast. An anatomical examination of the Kenya plants, however, showed the characteristics attributed to this species: poorly developed supporting cells to the assimulatory filaments, absence of tumid basal cells, absence of sharp differentiation as between medullary and cortical layers.

4509. Diani, outer reef, (only three plants found) 2.12.68.

4780. Tiwi—pools on outer edge of reef. 30.12.69.

G. oblongata (Ell. & Sol.) Lamour.

Chou, 1947, pp. 7–9, Pls. 2, 3, 9.

Boergesen, 1942, pp. 49–50; 1949, pp. 41–44.

Chou points out the close similarity between this species and *G. cylindrica* which ". . . are separated entirely on the basis of the diameter of the branches" those of the latter being very slender and commonly do not exceed 1 mm. diameter. (Chou, 1947, p. 6). On this basis the Kenya plants, in the main, best agree with *G. oblongata*.

Another very similar plant is *G. fastigiata* Decne. which is regarded by Chou as a physiological form of *oblongata.* Svedelius, however, maintains *G. fastigiata* and *G. oblongata* as closely related but distinct species (Svedelius, 1953).

3867. Mambrui. 2.12.67.

4551. Diani, outer reef. 20.12.68.

4552. ,, ,, ,, ,, . Possibly *G. cylindrica sensu* Chou

4778. Diani, pools. 26.12.69.

Scinaia furcellata (Turn.) Bivonia

Durairatnam, 1961, p. 48–49., Pl. 28, Fig. 2.

3849. Mambrui. 2.12.67. Identification confirmed by Durairatnam.

Yamadaella cenomyce (Decne.) Abbott

Abbott, Isabella A, 1970

In the first list of Kenya marine algae (Isaac, 1967), *Liagora cenomyce* Decne. was included. Subsequently a number of further specimens of this taxon were sent to Dr. Abbott for confirmation.

As a result of studying this material Dr. Abbott has established the genus *Yamadaella* and *Liagora cenomyce* now becomes *Y. cenomyce*. The following numbers were named by Dr. Abbott.

2059. Diani, outer reef. 16.3.65.
2653. Tiwi, 1.8.65.
4483. Tiwi, 29.11.68.
4745. Diani, outer reef. 5.7.65.
4747. Diani ,, ,, 1.8.69.

Gelidiales

Gelidium arenarium Kylin

Kylin, 1938, p. 8, Fig. 2,D.

4787. Diani. Epiphytic on *Cymodocea ciliata*. 12.1.67.

This species was described from material collected at Isipingo in the Durban area.

G. rumpii Dickinson.

Dickinson, 1949, p. 565, Plate 4.

Two new species of *Gelidium* from Natal (Richard's Bay) were described by Dickinson (1949)—*G. helenae & G. rumpii*. The differences between them are slight and it would not be surprising if further work on large collections were to show that there is only one species. The plants of this very limited Kenya material are even shorter than those described by Dickinson in the smaller species, *G. helenae* (27 cms.). On balance the Kenya plants seen agree better with the photograph of *G. rumpii* (Plate 4) than of *B. helenae* (Plate 3).

4791. (Herb. W. E. Isaac) Watamu, July 1968. Collector, F. Furmani.

Cryptonemiales

A. *Corallinaceae:* Articulated species.

Three species of articulated corallines were included in each of the first two lists of Kenya marine algae (Isaac, 1967, 1968). Subsequently much material of this group was sent to Dr. William Johansen of Clark University, Massachusetts between whom and the author there was correspondence regarding these plants. Dr. Johansen named a large number of specimens and clarified certain questions in correspondence. Most of the numbers cited below were named by him and a collection of named plants has been deposited in the Botany Department of Nairobi University. I am very grateful to Dr. Johansen for all the trouble he has taken.

Amphiroa anceps (Lam.) Decne.

Weber van Bosse & Foslie, 1904, pp. 93–95, Pl. 16, figs. 6–8.

4320, 4321, 4325. Malindi, Silversands. 3.12.67.

4481, Diani, 17.6.65.

4519. ,, , 2.12.68.

4545, 4546, 4547, 4548, Diani—outer reef. 20.12.68.

4578, Tiwi, inshore. 22.12.68.

Some of the specimens named *A. anceps* by Johansen had been previously named *A. beauvoisii* (Isaac, 1967). Probably all the "*beauvoisii*" material needs re-examination and for the present the name should be withdrawn from the list of Kenya marine algae.

The Kenya material of *A. anceps* is very variable. Thus 4321 is a much broader, thinner and more flattened form than 4320 and 4325.

A. fragilissima (Linn.) Lamour.

Weber van Bosse & Foslie, 1904, pp. 89–91, Pl. 14, fig. 12.

Taylor, 1928, p. 204, Pl. 29, fig. 11, Pl. 36, fig. 6.

This species was included without specimen numbers A in second list of Kenya marine algae (Isaac, 1968).

3647, 3649, 3652. Diani, outer reef. 20.8.67.
3657, 3658. Diani. 10.8.67.
3958, 3959, 3961, 3962, 3964, 3966, 3967. Malindi, Casuarina Point. 1.12.67.
3973. Malindi, Silversands. 3.12.67.
4491. Tiwi, inshore reef. 29.11.68.
4611. Diani, 2.12.68.

A. tribulus (Ell. & Sol.) Lamour.
Weber van Bosse & Foslie, 1904, p. 99.
Taylor, 1928, p. 204, Pl. 29, figs 7 & 9; Pl. 36, fig. 1.
„ , 1960, pp. 406–407, Pl. 47, figs 4 & 5.

In general appearance this species recalls *A. foliacea* Lamour. Johansen agrees, however, that the bands of dark genicula are always broader and more prominent in *A. foliacea* than in *A. tribulus*. He adds ". . . . in *A. tribulus* the genicula are not as broad as the intergenicula." (Private communication).

3810. Diani. April 1964.
3960, 3963, 3965. Malindi, Casuarina Point. 1.12.67.
3970, 3974, 3995. Malindi, Silversands. 3.12.67.
4601. Diani, in surf at edge of outer reef. 20.12.68.
4610 „ , outer reef. 2.12.68.
4659 Diani. 4.4.69.

Cheilosporium jungermannioides Rupr.
Boergesen, 1953, p. 26, Fig. 7.
3969. Malindi, Casuarina Pt. 3.12.67.

Corallina subulata Ell. & Sol.
Taylor, 1960, P. 410, Pl. 50, figs. 1 & 2.

In a letter Johansen notes: "I have studied this species in South Africa and have found that it is much closer to *Jania* than to *Corallina* (as exemplified by *C. officinalis*) and plan to elevate Decaisne's *Jania* group *Haliptylon* in the near future. Then this species will become *H. subulata* (Ell. & Sol.) Joh.".

3653. Diani, outer reef. 20.8.67.
3654. Diani, cast up. 13.8.64.
4482. Diani, cast up. 13.8.67.
4664. Diani, reef. 4.4.69.

Johansen comments that he strongly suspects that *C. subulata*, *C. polydactyla* and *C. mauritiana* all represent one species.

Jania adhaerens Lamour.
Taylor, 1928, Pp. 205–206; 1960, p. 413, Pl. 49, figs. 1 & 2.
Boergesen, 1953, p. 27.
Kuetzing, 1858, *Tab. Phyc.*, Vol **8**, Pl. 83, II.

Johansen notes in a letter: "*Jania* is confusing; your specimens seem to fit into two species. Specimens such as number 3656 contain plants of two sizes, however, and it is possible that three species are represented." A later letter in reply to an enquiry contained a comment on the differences between *J. adhaerens* and *J. capillacea*. "The small, divaricate, epiphytic Janias in South Africa mostly agree with the type of *adhaerens* although the range of variability in intergenicular dimensions varies from and includes those given for *J. capillacea*."

3646. Diani, North Cove. 30.6.67.
3656. Diani, Reef. 10.8.64.
3968. Malindi, Casuarina Point. 1.12.67.
4681. Tiwi, Moonlight Bay. Dense epiphytic growth on old *Sargassum* stipes. 6.4.69.

J. pumilla

Taylor, 1928, p. 206, Pl. 29, fig. 8.; 1960, pp. 414–415, Pl. 49, fig. 5.
Kuetzing, 1958, *Tab. Phyc.*, Vol. 8, Pl. 83, I

4582. Tiwi, inshore reef. Epiphyte on *Turbinaria*. 22.12.68. Some of material is male.

The only collection made of this species.

In view of Johansen's identifications and comments, the occurrence of *Amphiroa beauvoisii* and *Jania capillacea* (included in the first list of marine algae: Isaac, 1967) on the Kenya coast needs confirmation. The same need of confirmation holds for *Amphiroa foliacea*, included in the second list (Isaac, 1968). *Corallina mauritiana* (list 2) possibly needs re-naming as *C. subulata*.

B. *Crustose Species*

The following identifications were made by Dr. W. H. Adey, Smithsonian Institution, Washington, D.C. to whom grateful acknowledgement is made. Dr. Adey reports that amongst the collection sent to him there were four undescribed species of *Neogoniolithon* and that if he can obtain additional material of these and other species he would like to accomplish a detailed study of the crustose corallines of the East African Coast.

The fact that most of the specimens cited are from the Diani Beach area is not significant. It was only towards the end of the working period that there was a chance for Mrs. F. M. Isaac to collect a few specimens in the hope that Dr. Adey would find time to identify them. On earlier forays crustose corallines were observed in all places visited where reef conditions prevail but they were not collected and studied.

Archaeolithothamnium erythraeum (Rothpletz) Foslie

3659. Diani—outer reef in pools and on edge of surf. 25.8.67.
4699. Diani—outer reef in pools and edge of surf. 20.8.67.
4673. Tiwi—Moonlight Bay in pools on inshore dead reef. 6.4.69.

Choreonema thuretii (Bornet) Schmitz

epiphytic with *Corallina subulata* on *Cymodocea ciliata*
3654. Diani. 13.8.64.
This name was given by Dr. H. W. Johansen.

Heteroderma sp.

4665. Diani—in pools on outer reef, 4.4.69 epiphytic on *Cymodocea*. Crustose corallines of this type are present in abundance on all the broad leaved Marine Angiosperms wherever they occur.

Hydrolithon reinboldii (Weber van Bosse & Foslie) Foslie

4639. Diani—outer reef in depression in the surf on the seaward side. 4.4.69.

Lithophyllum moluccense Foslie

3971. Malindi, Silversands Beach. 3.12.67.

L. kotschyanum Unger.

3651. Diani — pools on reef. 20.8.67.
4643. ,, — on lumps of old coral in pools and in depressions in the surf beyond the reef. 4.4.69.
4652. ,, — in a pool on outer reef. 4.4.69.
4792. Tiwi. Moonlight Bay in pools on inshore dead reef. 6.4.69.

Melobesia sp.

4677, 4697. Tiwi, Moonlight Bay. 6.4.69.

Mesophyllum crispescens (Foslie) Lemoine
3956, 4701. Watamu Region; Blue Lagoon. 9.4.67.
M. erubescens (Foslie) Lemoine
3645. Diani — in pools on outer reef. 6.7.67.
4655. ,, ,, ,, ,, ,, ,, 4.4.69.
4651, 4654 ,, — in depressions in surf on outer edge of the reef. 4.4.69.

Neogoniolithon accretum (Foslie & Howe) Setchell & Mason
4634, 4636, 4637, 4638, 4641. Diani outer reef in pools. 4.4.69.
N. trichotomum Heydrich
3955. Lamu Region—Manda Is. Kitau. 27.3.67.

Porolithon onkodes (Heydrich) Foslie
4635, 4644. Diani—outer reef in pools. 4.4.69.

C. *Non-Corallinaceae*
Peyssonnelia rubra (Grev.) J. Ag..
Durairatnam, 1961, p. 52.
Taylor, 1950, p. 121–122.
2909. Mombasa, Mackenzie Point. 8.12.65.
Plants mostly of dark rose-red colour, thin and with short non-separate rhizoids.

Gigartinales

Gelidiopsis intricata (Ag.) Vickers
Boergesen, 1943, pp. 53–54, Fig. 25.
Kuetzing, 1868, *Tab. Phyc.*, Vol. **18,** Pl. 35 sub nom. *Acrocarpus intricatus.*
2743A. Watamu, Turtle Bay. Epiphytic.
Determined by A. B. Cribb.

Gracilaria
The following species were previously recorded. *G. cacalia, crassa, edulis, millardetii, verrucosa* (Isaac, 1967), *arcuata, corticata, corticata* v. *ramalinoides* (Isaac, 1968).

G. arcuata Zanard. var. *snackeyi* Weber
Boergesen, 1943, pp. 69–71, Fig. 35.
4297. Diani, outer reef. 19.12.67.
The agreement with Boergesen is reasonably good and so this can be named v. *snackeyi* (prox).

G. bursa—pastoris (Gmel.) Silva
Ohmi, 1958, pp. 18–20, Pl. 3, C & D, Pl. 4, A & B.
Durairatnam, 1961, pp. 60–61.
Sub nom. G. compressa, Okamura, 1927, *Icones*, Vol. **5,** pp. 160–162, Pl. 242, Figs. 5–10.
Taylor, 1928, p. 152, Pl. 33, Fig. 1.
3212. Mokowe. 26.3.67.
3581. Gazi. Identified by Durairatnam. 11.8.67.
4793. Gazi, in channels in front of mangrove. Epiphytic (along with a number of other algal species) on *Halodule uninervis* (Forsk.) Aschers.

G. dura (Ag.) J. Ag.
Boergesen, 1951, pp. 41–42, Pl. 7.
The specimens collected although smaller are remarkably similar to that figured by Boergesen.

4501. Diani. Collected on old coral rocks of inshore reef which had recently been scoured by changing currents and were a new young growth. 30.11.68. Collected by Mrs. F. M. Isaac.

G. foliifera (Forsk.) Boergs.
Boergesen, 1933b.; p. 124.
,, 1939, pp. 109–110. Fig. 29, for a chondrus-like form.
Taylor, 1960, pp. 446–447, Pl. 55; fig. 1.
Durairatnam, 1961, p. 63, Pl. 31, Fig. 2.
Sub-nom. Fucus aeruginosus, Turn., 1811, Vol. **3**, pp. 29–30, Pl. 147.
A very variable species as a scrutiny of the relevant literature will indicate.
2071. Diani, outer reef. 16.3.65. Determined by Durairatnam.
2124. Diani, reef. 19.3.65.
2470. Diani, Cystocarpic. 18.7.65.
3118. Diani. 26.12.66.
3326. Ras Takwa, Manda Island. 30.3.67.
Similar to the Iranian gulf form figured by Boergesen (1939).
3871. Mambrui. 2.12.67. From as for 3326.
4370. Diani, on inshore reef ("Jadini Banks").

G. purpurascens (Harv.) J. Ag.
Ohmi, 1958, pp. 30–34, Pl. 6, C, D, & E.: Pl. 7, A. & B.
Sub-nom. Rhodymenia spinulosa Okamura, *Icones* 1922, Vol. **7**, p. 33, Pl. 318, Figs. 1–6.
The Kenya plants collected are, or approximate to f. *spinulosa* (Ohmi, 1958, pp. 32–34).
3861, 3882. Mambrui. 2.12.67.
3931. Malindi, near Vasco da Gama padrao. 4.12.67.
4679. Tiwi, Moonlight Bay. 6.4.69.

G. salicornia (C. Ag.) Dawson
Dawson, 1954, pp. 4–6, Fig. 3.
Ohmi, 1958, pp. 27–29; Pl. 5, F., Pl. 6, A.
Typical specimens of this species are distinctive in that all the branches, branchlets and segments of axes show clear constriction downwards to base of segment, the plant showing a succession of elongated inverted pyriform segments. *G. cacalia* on the other hand, shows little or no attenuation of segments in the basal parts of main branches although branchlets arising from branch apices show marked constriction (Boergesen, 1934). Kenya plants, however, have been collected which are intermediate between *G. salicornia* and *G. cacalia.*
2359. Mokowe, to seaward of Mangroves. 30.6.65.
2374. Lamu, on flats among mangrove to N.W. of town. 1.7.65.

Hypnea
The following species were previously recorded. *H. cervicornis, cornuta, harveyi, musciformis, rosea, valentiae* (Isaac, 1967); *boergesenii, nidulans* (Isaac, 1968).
H. esperi, Bory
Boergesen, 1950, p. 16.
Kuetzing, 1868, *Tab. Phyc*, Vol. **18**, Pl. 26.
Tanaka, 1938, p. 243, Fig. 15.
2250. Diani. 1.1.65.
2439. Manda Toto Island. 4.7.65.
4500. Diani, on scoured rocks; one of the earliest plants to return. 30.11.68.
The identification of these plants was aided by comparison with material named *H. esperi* by A. B. Cribb.

H. hamulosa (Turn.) Montagne
Turner, 1809 *Fuci*, Vol. **2**, l. 79, p. 19–20.
Tanaka, 1938, p. 245–246, Fig. 17.
Durairatnam, 1961, p. 56, Pl. 15, Figs. 10 & 11.
2552. Diani, outer reef. 30.7.65.

Sarcodia montagneana J. Ag.
Okamura, 1921, *Icones*, Vol. **4**, pp. 110–111, Pl. 177, Figs. 1 & 2. Pl, 178, Figs. 8–11.
Boergesen, 1954, pp. 28–30.
Sub nom. S. ceylanica, Kuetz., 1869, *Tab. Phyc*, Vol. **19**, p. 33.

This is a very variable species. Boergesen (1954) refers to this species not only *S. ceylanica* but also his own previous species *S. mauritiana* (Boergesen, 1952, pp. 29–31).

3878. Mambrui. 2.12.67. Cystocarpic.
3930. Malindi, near Vasco da Gama padrao. 4.12.67. Cystocarpic.
4327. Mambrui. 2.12.67. Approximating to sterile form figured by Okamura, 1921, Pl. 177, Fig. 1.

A common plant in places in Mambrui and Malindi. Only one inadequate and doubtful specimen (3502) found south of Malindi at North Cove, Diani.

Sarconema spp.
3851. Possibly *S. filiforme* (Sond.) Kylin
Boergesen, 1934, pp. 11–12, Fig. 7, Pl. 2.
Sub nom. *Cystoclonium filiforme* Kuetz.
Kuetzing, 1868, *Tab. Phyc.* Vol. **18**, Pl. 18.
3851. Mambrui. 2.12.67.

Shows a fair agreement in its anatomy with that of *S. filiforme* as figured by Kuetzing (1868) and Boergesen (1934). The plant is, however, more slender than indicated in Kuetzing figure.

4784. Watamu. July 1968, collected by F. Furnani. A larger, coarser plant which agrees well with *S. furcellatum* Zan.
Boergesen, 1934, p. 12, Fig. 8.
,, , 1939, pp. 11–112.
Sub. nom. Trematocarpus furcellatus Kuetz.
Kuetzing, 1869, *Tab. Phyc.* Vol. **19**, Pl. 73.

Ceramiales

Acanthophora dendroides Harv.
Boergesen, 1934, Pp. 22–23, Pl. 4.
3902. Mambrui. 2.12.67.

Acrosorium uncinatum (J. Ag.) Kylin
Taylor, 1960, pp. 552–553, Pl. 58, fig. 2.
Sub nom. Fucus laceratus, Turn., 1808, Fuci, Vol. **1**, pp. 151–152, Pl. 68. *Nitophyllum uncinatum* (Turn.) J. Ag., Okamura, 1908, *Icones*, Vol. **1.**, pp. 121–122, Pl. 26.

Most of the plants collected were epiphytic on articulated corallines.

3900. Mambrui. 2.12.67. Determined by Ann Mitchell.
4510. Diani, outer Reef. 2.12.68. Epiphytic on *Cymodocea ciliata.*
4518. Diani, outer Reef. 2.12.68. Epiphytic on *Amphiroa anceps.*
4585. Tiwi, deep pools on seaward edge of inshore reef. 22.12.68. Epiphytic on *Amphiroa.*
4631. Malindi, Silversands beach. 3.12.67. Epiphytic on *Amphiroa anceps.*
4695. Lamu. July 1965.

Amphisbetema indica (J. Ag.) Weber van Bosse

Weber van Bosse, 1913, pp. 133–135, Fig. 1, Pl. 13, Fig. 24.

The identification of material of this species was confirmed by Womersley.

Forms more or less dense clumps of rose coloured plants near or at the outer reef edge. Characteristically it occurs rooted in sand or in the proximity of much sand.

2069. Diani. 16.3.65.
2494. ,, 27.7.65.
2934. ,, 9.12.65.
3136 ,, 27.12.66.
3614. ,, 20.8.67.
4550. ,, 20.12.68.

Conditions on the outer reefs at Diani seem well suited to this species.

Bartoniella crenata (J. Ag.) Kylin

Kylin, 1956, p. 432.

The material of this taxon was identified by Mrs. Ann Mitchell of Adelaide University.

3892. Mambrui. 2.12.67.
3897. ,, ,, . Epiphytic along with a number of other algae, on *Cymodoceae ciliata.*

Bostrichia

Most of the material of this genus was named by Dr. Erika Post who identified the following taxa—

B. binderi Harv. f. *terrestre.*

4758. Tiwi, Moonlight Bay. 2.1.70.

Intermingled with *B. tenella, Murrayella periclados, Catanella opuntia* and *Caulacanthus* sp. On cave walls and cliffs, splashed at neap tides.

B. binderi Harv. f. *typica* Post

4759. Tiwi, Moonlight Bay. 2.1.70 with some f. *terrestre* and *B. tenella.* Emersed at neap tides on cliffs and cave walls.

B. tenella (Vahl) J.Ag.

3936. Malindi, on cliffs near Vasco da Gama padrao 4.12.67.
4506. Diani, cliffs below Holyoak house. Dry at neap tides, above splash zone. Mingled with *B. binderi* and *Murrayella periclados.*

4758 and 4759, see above.

4761. Diani, North Cove. 30.6.67.

The numbers cited do not exhaust all the identifications made.

Cruania attenuata (Bonnemaison) J. Ag.

Okamura, 1926, *Icones*, Vol. **5**, pp. 124–125, Pl. 235, Figs. 15–21.

Taylor, 1928, p. 193, Pl. 27, Figs. 7–9, Pl. 32, Fig. 9.

2297. Diani, outer reef. 17.6.65.
2499. ,, ,, 27.7.65. Epiphytic on *Gelidiella acerosa.*
4752. Diani, outer reef. 1.8.69. Epiphyte on *Tolypiocladia glomerulata*, in turn epiphytic on *Liagora.*

Griffithsia rhizophora Grunow ex Weber van Bosse. Tentative

Abbott, 1946, pp' 443– 4, Pl. 1, figs. 5–9.

4694. Mida Creek. 6.4.69.

Tentative identification by R. N. Baldock who writes: "A small lateral with moniliform habit and forcipate apices makes me suspect that it is the rather gnarled base of an old plant of *G. rhizophora* that is just commencing regrowth." (Private communication).

3700. (6.9.67) is material of this species from the island of Mafia off the coast of Tanzania. Identified by Baldock.

Haloplegma duperreyi Mont.

Boergesen, 1945, pp. 11–16, Figs. 3–8 (Anatomical details); 1952, p. 52, Fig. 26 (whole plant); 1931, p. 14, Fig. 9.

Kuetzing, 1862, *Tab. Phyc.*, Vol. **12,** Pl. 62.

4541. Diani, outer reef. 20.12.68. Epiphytic on *Cymodocea ciliata.*
Spongy appearance under a lens and anatomical characteristics agree well with available descriptions of this species.

Laurencia

The following species were previously listed: *L. flexilis, obtusa, papillosa, perforata* (Isaac, 1967).

L. ceylanica J. Ag.

Durairatnam, 1961, p. 74, Pl. 17, Figs. 6 & 7.

3339. Manda Island, Ras Takwa. 30.3.67.
Determined by Durairatnam.

L. distichophylla J. Ag.

Boergesen, 1952, pp. 65–66, Fig. 32.
(Boergesen adds a "?" after J. Ag.)

2541. Tiwi. 1.8.65. Surface cells do not form a clear palisade and are not mammillate.

3624. Diani. 10.8.67.

L. obtusa (Huds.) Lamour. prox. var. *majuscula* Harv.

Tseng, 1943, p. 200.

Boergesen, 1933, pp. 135–136.

3014. Watamu, Turtle Bay. 6.4.66.
Determined by A. B. Cribb.

L. parvipapillata Tseng

Tseng, 1943, pp. 204–205, Pl. 4.

This species has a characteristic anatomy. In transverse section the epidermal cells are very markedly mammillate, otherwise subquadrate and somewhat radially elongated.

2426. Kitau, Manda Island. 2.7.65.

Somewhat smaller than Tseng's description. Anatomy as indicated above.

These plants formed cushions at low inter tidal levels: dark green in colour with pinkish tipped short branches.

Murrayella periclados (C. Ag.) Schmitz

Kylin, 1956, pp. 516–517, Fig. 410.

Taylor, 1960, p. 593.

The following identifications of this species were made by Dr. Erika Post. The plant was intermingled with other species.

4390. Diani. 11.4.67. Cliffs.

4506. ,, 30.11.68.

4758. Tiwi, Moonlight Bay. 2.1.70.

4760. ,, ,, ,, ,, , Sorted out and determined by F.M. Isaac.

Spermothamnion sp.

3864. Mambrui. 2.12.67. Tetrasporic plants.

In this material the tetrasporangia are all sessile. Otherwise the plants have the general vegetative characters of *S. cymodocea* (Boergesen, 1952, pp. 54–57, Figs. 27 & 28).

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(*Received 4th June 1970*)

Published by The East Africa Natural History Society, Box 4486, Nairobi, Kenya and printed by Kenya Litho Ltd., Box 775, Nairobi.

JOURNAL OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 28 15th MAY 1971 No. 123

EAST AFRICAN BIRD RINGING REPORT 1969-1970

By

G. C. Backhurst

INTRODUCTION

This report covers the period 1st July, 1969 to 30th June, 1970. The total number of birds ringed this year was only 14402 (see TABLE 1), however the reasons for this decline (compared with the previous year's totals, Backhurst, 1970) were that Dr. E. D. Steel left the country and that my wife and I did not spend three months' leave ringing birds during this year. Furthermore, the number of Yellow Wagtails *Motacilla flava* ringed is low because their permanent roost was not found.

The full list of birds ringed is given in TABLE 1 where Palearctic migrants are printed in bold type; birds which are Ethiopian as well as Palearctic are printed in ordinary type. The nomenclature used follows the lists of C.M.N. White (references in Backhurst *op.cit.*) and as these lists are regarded as the standard for the Ethiopian Region authors' names have been omitted.

An innovation is the inclusion of three maps, the first two showing recoveries, the third showing ringing sites. There have been 31 recoveries in the Palearctic Region since the first East African-ringed Yellow Wagtail was shot in Qatar in April, 1967, all of these are plotted on the maps.

SOME NOTES ON RINGING IN EAST AFRICA

Thirteen ringers or ringing groups were operating in the three East African countries this year; P. L. Lack ringed for a short while in the Serengeti and J. F. Reynolds started a fairly extensive programme around Iringa, Southern Tanzania. Apart from a few birds which I ringed at Amani all other ringing was done in Kenya and Uganda.

Western Kenya is well covered by P. L. & Mrs. H. A. Britton and J. F. & Mrs. L. M. Harper who operate in Central Nyanza and M. & Mrs. G. Sugg who were working at Rapogi, South Nyanza District. The remaining Kenya ringers are based in or near Nairobi. In Uganda M. P. L. Fogden continues to ring mainly in Queen Elizabeth National Park, R. J. Wheater and R. Ziegler mainly in Murchison Falls Park and G. N. Harrington, M. Reid and E. R. Waterhouse operate in the Mbarara area in the south-west.

From the list of recoveries (TABLE 2) some interesting facts emerge: one is that so few non-passerines were recovered, another is that the Swallow *Hirundo rustica*, and possibly the House Martin *Delichon urbica*, are birds well worth ringing in Africa for recovery in their breeding areas; this has been demonstrated already by the success of the South African ringing scheme's effort with Swallows (Rowan, 1968, Elliot & Jarvis, 1970, Mead, 1970). The reason for the high recovery rate in these species is that in the Palearctic

the birds are found in proximity to man where many of those which die are likely to be found and reported, if ringed. In winter the story is very different with the Swallow being dispersed over vast tracts of open country sparsely populated by man. The winter quarters of the House Martin are not well known but must be well away from large concentrations of people. Needless to say, few European-ringed hirundines are recovered in Africa except at the roosts in South Africa where they are controlled by ringers. Harrington, Reid and Waterhouse have ringed 443 European Swallows around Mbarara of which four have been found in four different countries in the Palearctic (shown by open circles with "H" on Map 2). Rowan (*op. cit.*) gives a recovery rate (excluding local recoveries) of 0.25 per cent for South African-ringed Swallows and shows that this is very high compared with the distant recovery rate for European-ringed birds, thus the rate of 0.9 per cent distant recoveries from Mbarara is quite remarkable; the rate for all East African-ringed Swallows other than those ringed at Mbarara is under 0.23 per cent. In contrast, only 11 Yellow Wagtails have been recovered in the Palearctic from 20667 ringed, a meagre rate of just over 0.05 per cent, or one recovery per 1878 birds ringed; the Mbarara Swallow rate expressed in this way is one recovery per 111 birds ringed and for the rest of the East African-ringed Swallows is one recovery per 352 birds ringed.

A disappointing fact to emerge from TABLES 1 and 2 is that the Little Stint *Calidris minuta* has not yet given any recoveries: it may be recalled that one bird ringed in Zambia was controlled at Lake Nakuru in 1968 (Backhurst, 1969) but no East African-ringed birds have been controlled or recovered either to the north or the south. It should be mentioned that the only cases of ring corrosion which have come to light have occured on rings being carried by Little Stints; all three examples are from birds which, it is very reasonable to assume, have migrated north after ringing before being trapped again by ringers in East Africa. The first two rings affected were aluminium and the whole surface and inscription were *partially* corroded making them almost illegible; the third ring was of "Monel" (a nickel alloy) which showed the apparently well known "crevice attack" which, in this example, caused the prefix "X" to become a hole. All three cases took less than a year to develop. Robert Spencer tells me (pers. comm.) that "crevice attack" is known to occur in rings worn by birds wintering in the tropics, however it is interesting to note that corrosion has never been detected on rings worn by other wader species. Moreover, Blacksmith Plovers *Vanellus armatus* which live all the year in the tropics have rings in perfect condition after four years at least. It seems likely that corrosion of stint rings may take place to the north of the tropics, but the fact that corrosion *does* occur may account for the lack of recoveries in this species. We have taken the opportunity of using rings made by a different manufacturer on this species from the beginning of the 1970-1971 season so that we may assess their performance by retrapping later in the season and subsequent seasons.

TABLE 1

BIRDS RINGED BY THE EAST AFRICA NATURAL HISTORY SOCIETY RINGING ORGANIZATION

Palearctic Migrants in Bold Type	1969/70	Grand Total
Podiceps ruficollis Little Grebe	0	1
Ardeola ibis Cattle Egret	0	1
A. ralloides Squacco Heron	0	1
Ixobrychus minutus Little Bittern	1	1
Nycticorax nycticorax Night Heron	1	1
Phoenicopterus minor Lesser Flamingo	1	12
P. ruber Greater Flamingo	1	1
Platalea alba African Spoonbill	0	73
Threskiornis aethiopica Sacred Ibis	0	7
Alopochen aegyptiaca Egyptian Goose	1	1
Anas capensis Cape Wigeon	53	168
A. erythrorhynchos Red-billed Duck	0	43

Palearctic Migrants in Bold Type	1969/70	Grand Total
A. hottentota Hottentot Teal	29	120
A. querquedula Garganey	0	7
A. undulata Yellow-billed Duck	0	36
Netta erythrophthalma African Pochard	0	4
Dendrocygna bicolor Fulvous Tree-Duck	1	1
Accipiter badius Shikra	0	3
A. minullus Little Sparrow Hawk	1	1
A. tachiro African Goshawk	1	1
Lophaetus occipitalis Long-crested Eagle	1	1
Milvus migrans migrans Black Kite	1	2
Falco biarmicus Lanner	0	2
F. cuvieri African Hobby	1	1
F. subbuteo Hobby	0	3
Polihierax semitorquatus Pigmy Falcon	1	1
Coturnix coturnix Quail	0	1
C. delegorguei Harlequin Quail	8	9
Fulica cristata Red-knobbed Coot	1	16
Gallinula chloropus Moorhen	0	1
Porphyrio porphyrio Purple Gallinule	2	2
Charadrius asiaticus Caspian Plover	0	1
C. dubius Little Ringed Plover	2	19
C. hiaticula Ringed Plover	12	86
C. leschenaultii Great Sand Plover	0	9
C. mongolus Mongolian Sand Plover	1	5
C. pallidus Chestnut-banded Sand Plover	0	100
C. pecuarius Kittlitz's Sand Plover	56	192
C. tricollaris Three-banded Plover	19	38
Vanellus armatus Blacksmith Plover	47	144
V. coronatus Crowned Lapwing	2	2
V. spinosus Spurwing Plover	3	14
Dromas ardeola Crab Plover	0	2
Cursorius chalcopterus Violet-tipped Courser	0	1
Glariola pratincola Pratincole	0	1
Actophilornis africana Jacana	1	1
Larus cirrocephalus Grey-headed Gull	0	4
Sterna leucoptera White-winged Black Tern	17	106
S. nilotica Gull-billed Tern	3	6
Himantopus himantopus Black-winged Stilt	12	26
Recurvirostra avosetta Avocet	0	6
Rostratula benghalensis Painted Snipe	13	16
Arenaria interpres Turnstone	1	1
Calidris alba Sanderling	0	1
C. ferruginea Curlew Sandpiper	63	159
C. minuta Little Stint	928	2409
C. subminuta Long-toed Stint	1	1
C. temminckii Temminck's Stint	3	10
Gallinago gallinago Snipe	30	52
G. media Great Snipe	3	3
G. nigripennis African Snipe	3	31
G. stenura Pintail Snipe	0	1
Philomachus pugnax Ruff	292	1866
Tringa erythropus Spotted Redshank	1	1
T. glareola Wood Sandpiper	101	425
T. hypoleucos Common Sandpiper	75	130
T. nebularia Greenshank	2	7
T. ochropus Green Sandpiper	6	15
T. stagnatilis Marsh Sandpiper	59	386
T. terek Terek Sandpiper	0	4
Oena capensis Namaqua Dove	3	3
Streptopelia capicola Ring-necked Dove	21	28
S. decipiens Mourning Dove	9	17
S. semitorquata Red-eyed Dove	6	6
S. senegalensis Laughing Dove	11	12
Turtur abyssinicus Black-billed Blue-spotted Wood Dove	1	1
T. afer Blue-spotted Wood Dove	31	49
T. chalcospilos Emerald-spotted Wood Dove	17	23
T. tympanistria Tambourine Dove	11	26

Palearctic Migrants in Bold Type	1969/70	Grand Total
Centropus superciliosus White-browed Coucal	2	4
Chrysococcyx caprius Didric Cuckoo	7	15
C. cupreus Emerald Cuckoo	0	1
C. klaas Klaas' Cuckoo	4	8
Tauraco hartlaubi Hartlaub's Turaco	2	2
Ciccaba woodfordii African Wood Owl	2	2
Glaucidium tephronotum Red-chested Owlet	0	1
Tyto alba Barn Owl	1	1
Caprimulgus climacurus Long-tailed Nightjar	1	4
C. fosii Gabon Nightjar	2	3
C. fraenatus Dusky Nightjar	1	1
C. poliocephalus Abyssinian Nightjar	0	1
Macrodipteryx longipennis Standard-wing Nightjar	0	1
Apus affnis Little Swift	0	162
A. caffer White-rumped Swift	2	4
Colius macrourus Blue-naped Mousebird	36	48
C. striatus Speckled Mousebird	88	155
Alcedo cristata Malachite Kingfisher	17	67
Ceryle rudis Pied Kingfisher	6	34
Ceyx picta Pigmy Kingfisher	75	125
Halcyon albiventris Brown-hooded Kingfisher	1	1
H. chelicuti Striped Kingfisher	3	7
H. leucocephala Grey-headed Kingfisher	5	9
H. senegalensis Northern Woodland Kingfisher	2	10
Tockus erythrorhynchus Red-billed Hornbill	1	1
Coracias caudata Lilac-chested Roller	1	1
C. garrulus Roller	1	1
Merops albicollis White-throated Bee-Eater	10	13
M. apiaster Bee-Eater	0	1
M. bullockoides White-fronted Bee-Eater	2	6
M. pusillus Little Bee-Eater	8	9
M. superciliosus persicus Blue-cheeked Bee-Eater	2	3
M. variegatus Blue-breasted Bee-Eater	1	3
Phoeniculus cyanomelas Scimitar-bill	1	3
P. minor Abyssinian Scimitar-bill	2	2
Upupa epops epops Hoopoe	0	1
Buccanodon olivaceum Green Barbet	6	6
Gymnobucco bonapartei Grey-throated Barbet	1	2
Lybius bidentatus Double-toothed Barbet	5	12
L. guifsobalito Black-billed Barbet	4	5
L. lacrymosus Spotted-flanked Barbet	21	44
L. leucocephalus White-headed Barbet	3	9
L. leucomelas Red-fronted Barbet	12	12
L. melanocephalus Brown-throated Barbet	1	1
Pogoniulus bilineatus Golden-rumped Tinker-Bird	5	16
P. chrysoconus Yellow-fronted Tinker-Bird	21	29
P. leucomystax Moustached Green Tinker-Bird	0	1
P. pusillus Red-fronted Tinker-Bird	1	3
Trachyphonus darnaudii d'Arnaud's Barbet	15	15
T. erythrocephalus Red and Yellow Barbet	1	1
T. purpuratus Yellow-billed Barbet	3	6
Indicator indicator Black-throated Honey-Guide	5	12
I. minor Lesser Honey-Guide	14	23
I. variegatus Scaly-throated Honey-Guide	1	2
Campethera cailliautii Little Spotted Woodpecker	1	1
C. nivosa Buff-spotted Woodpecker	0	3
C. nubica Nubian Woodpecker	6	12
Dendropicos fuscescens Cardinal Woodpecker	6	10
D. poecilolaemus Uganda Spotted Woodpecker	1	1
Jynx torquilla Wryneck	0	1
Mesopicos goertae Grey Woodpecker	3	8
Calandrella cinerea Red-capped Lark	1	1
Eremopterix leucopareia Fischer's Sparrow Lark	1	1
Mirafra africana Rufous-naped Lark	2	4
M. rufocinnamomea Flappet Lark	7	7
Campephaga phoenicea Black Cuckoo-Shrike	7	10
Dicrurus adsimilis Drongo	3	6

Palearctic Migrants in Bold Type	1969/70	Grand Total
D. ludwigii Square-tailed Drongo	0	1
Emberiza flaviventris Golden-breasted Bunting	1	5
E. tahapisi Cinnamon-breasted Bunting	2	2
Amandava subflava Zebra Waxbill	0	1
Clytospiza monteiri Brown Twinspot	12	22
Cryptospiza jacksoni Dusky Crimson-wing	0	2
C. salvadorii Abyssinian Crimson-wing	24	38
C. shelleyi Shelley's Crimson-wing	0	1
Estrilda astrild Waxbill	109	126
E. atricapilla Black-headed Waxbill	1	1
E. bengala Red-cheeked Cordon-bleu	55	79
E. cyanocephala Blue-headed Cordon-bleu	10	10
E. erythronotos Black-cheeked Waxbill	8	9
E. ianthinogaster Purple Grenadier	15	21
E. melanotis Yellow-bellied Waxbill	5	14
E. nonnula Black-crowned Waxbill	0	3
E. paludicola Fawn-breasted Waxbill	17	31
E. rhodopyga Crimson-rumped Waxbill	17	25
E. troglodytes Black-rumped Waxbill	0	1
Hypargos niveoguttatus Peters' Twin-spot	0	1
Lagonosticta rubricata African Firefinch	5	7
L. rufopicta Bar-breasted Firefinch	21	26
L. senegala Red-billed Firefinch	123	199
Lonchura bicolor Rufous-backed Mannikin	11	12
L. cucullata Bronze Mannikin	137	212
L. griseicapilla Grey-headed Silverbill	3	3
Nigrita canicapilla Grey-headed Negro Finch	5	9
Ortygospiza atricollis Quail Finch	2	2
Pytelia melba Green-winged Pytilia	24	40
Spermophaga ruficapilla Red-headed Bluebill	6	29
Vidua chalybeata Purple Indigo-Bird	7	9
V. hypocherina Steel-blue Whydah	1	1
V. macroura Pin-tailed Whydah	20	47
Serinus atrogularis Yellow-rumped Seed-eater	57	88
S. burtoni Thick-billed Seed-eater	8	11
S. canicollis Yellow-crowned Canary	18	18
S. citrinelloides African Citril	18	23
S. dorsostriatus White-bellied Canary	34	60
S. gularis	21	21
S. koliensis Papyrus Canary	37	37
S. mozambicus Yellow-fronted Canary	51	97
S. striolatus Streaky Seed-eater	72	87
S. sulphuratus Brimstone Canary	26	39
Delichon urbica House Martin	1	18
Hirundo abyssinica Striped Swallow	292	444
H. angolensis Angola Swallow	67	113
H. daurica Red-rumped Swallow	230	302
H. fuligula African Rock Martin	6	7
H. griseopyga Grey-rumped Swallow	4	4
H. rustica Swallow	1416	3259
H. semirufa Rufous-chested Swallow	2	6
H. senegalensis Mosque Swallow	1	2
H. smithii Wire-tailed Swallow	40	120
Psalidoprocne albiceps White-headed Rough-wing	31	42
P. pristoptera Black Rough-wing	20	32
Riparia cincta Banded Martin	451	462
R. paludicola African Sand Martin	537	1054
R. riparia Sand Martin	105	1034
Dryoscopus cubla Black-backed Puff-back	1	3
D. gambensis Puff-back	5	9
Eurocephalus anguitimens White-crowned Shrike	0	1
Laniarius barbarus Black-headed Gonolek	26	44
L. ferrugineus Tropical Boubou	8	21
L. funebris Slate-coloured Boubou	3	4
L. luehderi Lühder's Bush Shrike	8	10
L. mufumbiri Papyrus Gonolek	1	1
Lanius collaris Fiscal	25	40

Palearctic Migrants in Bold Type	1969/70	Grand Total
L. collurio Red-backed Shrike	29	107
L. excubitorius Grey-backed Fiscal	3	9
L. minor Lesser Grey Shrike	0	2
L. senator Woodchat Shrike	1	1
Malaconotus dohertyi Doherty's Bush Shrike	0	2
M. sulfureopectus Sulphur-breasted Bush Shrike	5	9
Nilaus afer Northern Brubru	3	4
Prionops plumata Curly-crested Helmet Shrike	0	3
Tchagra australis Brown-headed Bush Shrike	26	36
T. jamesi Three-streaked Bush Shrike	1	1
T. minuta Black-cap Bush Shrike	17	23
T. senegala Black-headed Bush Shrike	18	23
Anthus cervinus Red-throated Pipit	0	23
A. leucophrys Plain-backed Pipit	11	13
A. novaeseelandiae Richard's Pipit	33	35
A. trivialis Tree Pipit	4	121
Macronyx croceus Yellow-throated Longclaw	6	13
Motacilla alba alba White Wagtail	3	5
M. alba vidua African Pied Wagtail	82	142
M. capensis Cape Wagtail	2	3
M. cinerea Grey Wagtail	1	2
M. clara Mountain Wagtail	3	3
M. flava Yellow Wagtail	2185	20667
Batis capensis Puff-back Flycatcher	0	2
B. minor Black-headed Puff-back Flycatcher	13	18
B. molitor Chin-spot Puff-back Flycatcher	5	10
Bradornis microrhynchus Grey Flycatcher	5	5
B. pallidus Pale Flycatcher	1	2
Empidornis semipartitus Silver Bird	2	2
Hyliota flavigaster Yellow-bellied Flycatcher	1	1
Melaenornis chocolatina White-eyed Slaty Flycatcher	19	27
M. edolioides Black Flycatcher	11	21
Muscicapa adusta Dusky Flycatcher	6	8
M. aquatica Swamp Flycatcher	7	11
M. caerulescens Ashy Flycatcher	0	3
M. striata Spotted Flycatcher	13	27
Myioparus plumbeus Grey Tit Flycatcher	0	3
Platysteira blissetti Jameson's Wattle-Eye	0	28
P. castanea Chestnut Wattle-Eye	0	10
P. cyanea Wattle-Eye	20	30
P. peltata Black-throated Wattle-Eye	0	12
Terpsiphone rufiventer Black-headed Paradise Flycatcher	0	3
T. viridis Paradise Flycatcher	26	39
Trochocercus albonotatus White-tailed Crested Flycatcher	3	8
T. longicauda Blue Flycatcher	4	5
T. nigromitratus	2	20
Acrocephalus arundinaceus Great Reed Warbler	8	33
A. boeticatus African Reed Warbler	4	5
A. gracilirostris Lesser Swamp Warbler	14	18
A. palustris Marsh Warbler	25	34
A. rufescens Greater Swamp Warbler	15	21
A. schoenobaenus Sedge Warbler	26	291
A. scirpaceus Reed Warbler	84	419
Apalis cinerea Grey Apalis	0	1
A. flavida Black-breasted Apalis	5	6
A. pulchella Buff-bellied Warbler	7	7
A. pulchra Black-collared Apalis	6	12
Bathmocercus cerviniventris Black-faced Rufous Warbler	5	35
Bradypterus baboecala Little Rush Warbler	1	1
B. barratti Evergreen Forest Warbler	3	3
B. cinnamomeus Cinnamon Bracken Warbler	13	17
B. graueri White-winged Warbler	5	5
Camaroptera brachyura Grey-backed Camaroptera	92	150
C. chloronota Olive-green Camaroptera	5	35
C. simplex Grey Wren-Warbler	3	3
Chloropeta natalensis Yellow Flycatcher-Warbler	3	4
C. similis Mountain Yellow Flycatcher-Warbler	11	15

Palearctic Migrants in Bold Type	1969/70	Grand Total
Cisticola brachyptera Siffling Cisticola	1	1
C. brunnescens Pectoral-patch Cisticola	0	1
C. cantans Singing Cisticola	6	6
C. carruthersi Carruthers' Cisticola	11	15
C. chiniana Rattling Cisticola	6	7
C. erythrops Red-faced Cisticola	10	19
C. galactotes Winding Cisticola	54	87
C. juncidis Zitting Cisticola	1	1
C. hunteri Hunter's Cisticola	13	14
C. lateralis Whistling Cisticola	3	3
C. natalensis Croaking Cisticola	15	23
C. robusta Stout Cisticola	12	26
C. woosnami Trilling Cisticola	1	4
Eminia lepida Grey-capped Warbler	44	65
Eremomela icteropygialis Yellow-bellied Eremomela	3	4
Hippolais icterina Icterine Warbler	1	3
H. languida Upcher's Warbler	0	2
H. olivetorum Olive-tree Warbler	1	1
H. pallida Olivaceous Warbler	5	25
Hylia prasina Green Hylia	0	5
Locustella fluviatilis River Warbler	5	5
Phylloscopus budongoensis Uganda Woodland Warbler	1	2
P. trochilus Willow Warbler	192	619
P. umbrovirens Brown Woodland Warbler	25	30
Prinia bairdii Banded Prinia	4	17
P. leucopogon White-chinned Prinia	21	23
P. subflava Tawny-flanked Prinia	32	54
Schoenicola platyura Fan-tailed Warbler	1	1
Sphenoeacus mentalis Moustache Warbler	1	1
Sylvia atricapilla Blackcap	86	135
S. borin Garden Warbler	204	748
S. communis Whitethroat	23	34
S. nisoria Barred Warbler	2	9
Sylvietta brachyura Crombec	10	13
S. leucophrys White-browed Crombec	2	4
S. whytii Red-faced Crombec	15	18
Alcippe abyssinica Abyssinian Hill Babbler	12	23
Trichastoma albipecta Scaly-breasted Illadopsis	1	24
T. fulvescens Brown Illadopsis	0	10
T. pyrrhoptera Mountain Illadopsis	2	5
T. rufipennis Pale-breasted Illadopsis	5	21
Turdoides jardinei Arrow-marked Babbler	6	7
T. melanops Black-lored Babbler	4	6
T. plebjus Brown Babbler	14	39
T. rubiginosus Rufous Chatterer	1	1
Alethe poliocephala Brown-chested Alethe	11	50
A. poliophrys Red-throated Alethe	0	1
Cercomela sordida Hill Chat	7	7
Cercotrichas hartlaubi Brown-backed Scrub Robin	3	6
C. leucophrys Red-backed Scrub Robin	19	39
C. quadrivirgata Eastern Bearded Scrub Robin	0	5
Cossypha archeri Archer's Robin Chat	0	1
C. caffra Robin Chat	19	34
C. cyanocampter Blue-shouldered Robin Chat	5	12
C. heuglini White-browed Robin Chat	59	107
C. natalensis Red-capped Robin Chat	0	37
C. niveicapilla Snowy-headed Robin Chat	14	24
C. polioptera Grey-winged Robin Chat	6	7
C. semirufa Rüppell's Robin Chat	5	5
Luscinia luscinia Sprosser	11	15
L. megarhynchos Nightingale	1	7
Monticola rufocinerea Little Rock Thrush	2	2
M. saxatilis Rock Thrush	4	14
Myrmecocichla nigra Sooty Chat	0	1
Neocossyphus poensis White-tailed Ant-Thrush	0	3
Oenanthe isabellina Isabelline Wheatear	2	5
O. oenanthe Wheatear	8	24

Palearctic Migrants in Bold Type	1969/70	Grand Total
O. pileata Capped Wheatear	1	1
O. pleschanka Pied Wheatear	0	2
Phoenicurus phoenicurus Redstart	21	39
Pogonocichla stellata White-starred Bush Robin	28	52
Saxicola rubetra Whinchat	13	60
S. torquata Stonechat	3	5
Sheppardia aequatorialis Equatorial Akalat	5	42
Turdus abyssinicus Olive Thrush	81	108
T. pelios African Thrush	18	24
T. piaggiae Abyssinian Ground Thrush	4	5
Anthreptes collaris Collared Sunbird	19	25
A. longuemarei Uganda Violet-backed Sunbird	4	4
A. orientalis Violet-backed Sunbird	4	4
Nectarinia alinae Blue-headed Sunbird	0	7
N. amethystina Amethyst Sunbird	1	1
N. bifasciata Little Purple-banded Sunbird	24	37
N. chloropygia Olive-bellied Sunbird	5	5
N. cuprea Copper Sunbird	34	99
N. erythroceria Red-chested Sunbird	110	110
N. famosa Malachite Sunbird	1	1
N. kilimensis Bronze Sunbird	53	65
N. mariquensis Mariqua Sunbird	46	105
N. mediocris Eastern Double-collared Sunbird	11	39
N. olivacea Olive Sunbird	28	61
N. preussi Northern Double-collared Sunbird	16	29
N. pulchella Beautiful Sunbird	62	88
N. regia Regal Sunbird	0	2
N. reichenowi Golden-winged Sunbird	3	3
N. senegalensis Scarlet-chested Sunbird	38	95
N. tacazze Tacazze Sunbird	25	38
N. venusta Variable Sunbird	25	33
N. verticalis Green-headed Sunbird	27	42
Oriolus larvatus Black-headed Oriole	1	2
O. oriolus Golden Oriole	0	4
Parus albiventris White-bellied Tit	5	7
Passer eminibey Chestnut Sparrow	6	12
P. griseus Grey-headed Sparrow	47	108
P. iagoensis Rufous Sparrow	3	5
Petronia xanthocollis Yellow-spotted Petronia	10	10
Plocepasser donaldsoni Donaldson-Smith's Sparrow-Weaver	5	5
P. mahali Stripe-breasted Sparrow-Weaver	18	20
Sporopipes frontalis Speckle-fronted Weaver	2	2
Amblyospiza albifrons Grosbeak Weaver	6	7
Anamalospiza imberbis Parasitic Weaver	2	10
Euplectes albonotatus White-winged Widow Bird	82	96
E. ardens Red-collared Widow Bird	40	51
E. axillaris Fan-tailed Widow Bird	172	222
E. capensis Yellow Bishop	1	1
E. gierowii Black Bishop	8	25
E. hordeaceus Black-winged Red Bishop	23	38
E. jacksoni Jackson's Widow Bird	0	3
E. macrourus Yellow-mantled Widow Bird	15	18
E. orix Red Bishop	8	11
Malimbus rubriceps Red-headed Weaver	0	1
Ploceus alienus Strange Weaver	0	2
P. baglafecht Emin's, and Reichenow's Weavers	112	187
P. bicolor Dark-backed Weaver	0	1
P. bojeri Golden Palm Weaver	0	1
P. castanops Northern Brown-throated Weaver	78	82
P. cucullatus Black-headed Weaver	157	335
P. intermedius Masked Weaver	94	171
P. jacksoni Golden-backed Weaver	225	315
P. luteolus Little Weaver	17	19
P. melanocephalus Yellow-backed Weaver	508	943
P. melanogaster Black-billed Weaver	5	10
P. nigerrimus Vieillot's Black Weaver	9	9
P. nigricollis Black-necked Weaver	5	8

Palearctic Migrants in Bold Type	1969/70	Grand Total
P. ocularis Spectacled Weaver	71	118
P. pelzelni Slender-billed Weaver	182	283
P. rubiginosus Chestnut Weaver	3	3
P. spekei Speke's Weaver	94	94
P. superciliosus Compact Weaver	10	13
P. velatus Vitelline Masked Weaver	0	5
P. xanthops Holub's Golden Weaver	20	27
Quelea cardinalis Cardinal Quelea	36	78
Q. erythrops Red-headed Quelea	24	73
Q. quelea Red-billed Quelea	126	199
Andropadus curvirostris Cameroon Sombre Greenbul	0	19
A. importunus Zanzibar Sombre Greenbul	2	12
A. latirostris Yellow-whiskered Greenbul	76	398
A. milanjensis Stipe-cheeked Greenbul	2	2
A. montanus Shelley's Greenbul	2	9
A. tephrolaemus Olive-breasted Mountain Greenbul	57	76
A. virens Little Greenbul	11	35
Bleda syndactyla Bristle-bill	2	15
Chlorocichla flavicollis Yellow-throated Leaflove	15	32
C. flaviventris Yellow-bellied Greenbul	2	7
Phyllastrephus baumanni Toro Olive Greenbul	1	8
P. debilis Smaller Yellow-streaked Greenbul	0	3
P. fischeri Fischer's Greenbul	15	60
P. strepitans Northern Brownbul	0	7
P. terrestris Brownbul	0	7
Pycnonotus barbatus Dark-capped Bulbul	495	915
Buphagus erthrorhynchus Red-billed Oxpecker	0	2
Cinnyricinclus leucogaster Violet-backed Starling	3	36
Creatophora cinerea Wattled Starling	24	29
Lamprotornis caudatus Rüppell's Long-tailed Glossy Starling	5	8
L. chalybaeus Blue-eared Glossy Starling	4	4
L. chloropterus Lesser Blue-eared Glossy Starling	0	2
Spreo hildebrandti Hildebrandt's Starling	1	1
S. superbus Superb Starling	16	19
Zosterops abyssinica Yellow White-eye	12	23
Z. senegalensis jacksoni Green White-eye	78	92
Z. senegalensis kikuyuensis Kikuyu White-eye	42	47
Z. senegalensis kulalensis Kulal White-eye	4	4
TOTAL BIRDS RINGED	14 402	48 481
TOTAL SPECIES RINGED	364	450
TOTAL PALEARCTIC BIRDS RINGED	6 084	33 516
TOTAL PALEARCTIC SPECIES RINGED	52	67

TABLE 2

RECOVERIES AND CONTROLS OF BIRDS RINGED IN EAST AFRICA

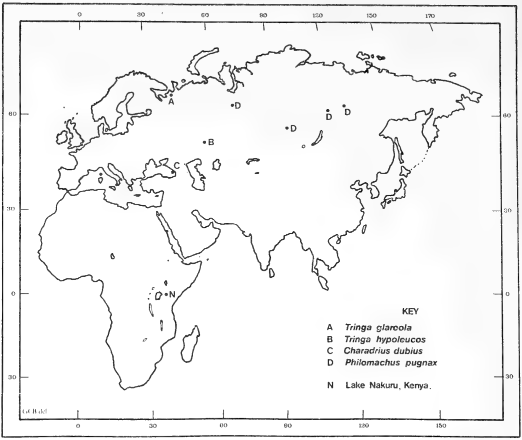
Key to symbols and terms

Ring number :		— Where this is in italics the ring has been returned.
Age	: f.g.	— full grown, age uncertain;
	ad.	— adult;
	pull.	— young, not able to fly freely;
	juv.	— juvenile, able to fly freely;
Sex	: ♂	— male.
	♀	— female.
Manner of recovery	: +	— shot or killed by man;
	×	— found dead or dying;
	xA	— found long dead;
	/?/	— manner of recovery unknown;
	v	— caught or trapped and released with ring (control);
	()	— caught or trapped alive and not released, or released with ring removed.

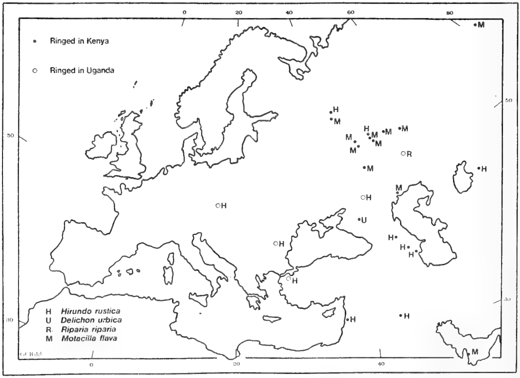
Date of recovery :	— Where this is unknown, the date of the reporting letter is given in brackets.
Distance :	— Only given for recoveries within East Africa.
Elapsed time :	— y=year; m=month.
Nomenclature:	— Follows the lists of C. M. N. White (full references given in Backhurst, 1970).

Anas hottentota			Hottentot Teal
H. 0113	f.g. +	31.7.69 7.2.70	Lake Nakuru, Kenya 0°20′S., 36°06′E. JFH. Ol Bolossat, Kenya 0°09′S., 36°26′E., 45km NE, 6m, R. Boy.
Charadrius tricollaris			Three-banded Plover
A. 8125	ad. v	8.3.70 4.10.70	Naivasha, Kenya 0°43′S., 36°25′E. GCB. Lake Nakuru, Kenya, 58km NW, 7m, GCB.
Calidris minuta			Little Stint
J. 24353	ad. v	15.3.69 10.10.70	Naivasha, Kenya. GCB. Lake Nakuru, Kenya, 58km NW, ly7m, GCB.
Philomachus pugnax			Ruff
B. 2822	ad. ♀ +	23.11.68 19.5.70	Lake Nakuru, Kenya. GCB. *near* Neryuktei, Olekmisk District, Yakut ASSR, **U.S.S.R.,** 60°41′N., 116°27′E., ly 6m, (RCM).
Delichon urbica			House Martin
J. 18869	juv. /?/	17.10.68 12.6.70	Kariobangi, Nairobi, Kenya, 1°15′S., 36°53′E. GCB. *near* Nevinnomyssk, Stavropol' Region, **U.S.S.R.,** 44°40′N., 41°45′E., ly 8m, (RCM).
Hirundo abyssinica			Striped Swallow
J. 10692	ad. /?/	3.3.69 *c.*18.1.70	Kabete, Kenya, 1°16′S., 36°43′E. GCB. Nairobi; precise details unknown—ring handed to Museum night-watchman.
J. 30622	ad. v	14.8.69 3.6.70	Kariobangi, Nairobi, Kenya. PLB. *near* Embakasi Airport—close to ringing place, 9½m, K. Mbuthia.
J. 27490	ad. ()	29.3.69 4.6.70	Luanda, *near* Waturi Point, Kenya, 0°27′S., 34°17′E., PLB. Waturi Point, ly 2m, C. Berg.
Hirundo daurica			Red-rumped Swallow
J. 30960	juv. +	16.8.69 28.11.69	Kariobangi, Nairobi, Kenya. GCB. *near* Kisii, Kenya, 0°41′S., 34°46′E., *c.*240km WNW, 3½m, J. O. Ogechi.
Hirundo rustica			European Swallow
J. 22961	ad. /?/	16.2.69 0.8.69	Naivasha, Kenya. EDS. *near* Khasavyurt, Dagestanian ASSR, **U.S.S.R.,** 43°15′N., 46°35′E., *c.*5½m, (RCM).
J. 33523	ad. ×	31.10.69 20.11.69	Kariobangi, Nairobi, Kenya. DA. Ruiru, Kenya, 1°10′S., 36°58′E., *c.*23km NE, ¾m, Miss E. Oxtoby.
J. 34120	f.g. ×	25.10.69 (24.11.69)	Lake Nakuru, Kenya. GCB. Kericho, Kenya, 0°22′S., 35°17′E., 90km NW, *c.*lm, P. C. Ondieki.
J. 32461	ad. ♀ /?/	26.10.69 *c.*14.3.70	Lake Nakuru, Kenya. JFH. Baqubah area, 60km NNE of Baghdad, **Iraq**, 33°30′N., 44°45′E., *c.*5½m, (Baghdad Museum).
J. 3502	ad. ♀ /?/	27.10.66 9.4.70	Thika, Kenya, 1°03′S., 37°05′E. DJMC. *near* Agdash, Azerbaijan SSR, **U.S.S.R.,** 40°38′N., 47°29′E., 3y 6m, (RCM).
J. 28512	juv. v ()	16.3.69 20.12.69 20.4.70	Muko, Uganda, 0°28′S., 30°44′E. HR&W. Muko, 9m HR&W. Mustafakemalpasa, Bursa, **Turkey,** 40°06′N., 28°23′E., 4m, I. Dilek.

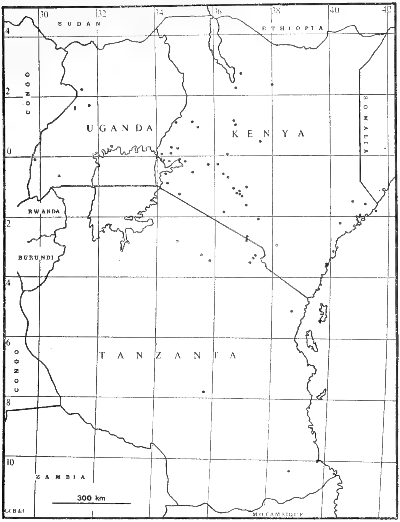
J. 33575	juv.	5.11.69	Kariobangi, Nairobi, Kenya. GCB.
	/?/	10.5.70	*near* Saatly, Azerbaijan SSR, **U.S.S.R.,** 39°56′N., 48°24′E., 6m, (RCM).
J. 39539	juv.	11.1.70	Ruhengere Field Station, Uganda, 0°22′S., 30°38′E., HR&W.
	v	19.5.70	Rosice, Brno District, **Czechoslovakia,** 49°11′N., 16°23′E., 4m, K. Bazovská.
J. 28547	juv.	12.1.70	Muko, Uganda. HR&W.
	/?/	0.6.70	*near* Dubovskoe, Rostov Region, **U.S.S.R.,** 47°24′N., 42°45′E., *c.* 4½m, (RCM).
J. 40847	juv.	15.1.70	Muko, Uganda. HR&W.
	/?/	20.6.70	Koprivetz, Ruse, **Bulgaria,** 43°24′N., 25°52′E., 5m, (Cent. d'Orn., Sofia).
J. 40291	juv.	20.10.69	Lake Nakuru, Kenya. PLB.
	/?/	19.7.70	Dbaye, Beyrouth, **Lebanon,** 33°30′N., 35°30′E., 9m, J. Kazau.
J. 32495	juv.	1.12.69	Maranda, Kenya, 0°05′S., 34°13′E., JFH.
	+	10.12.70	Butere, Kenya, 0°13′N., 34°30′E., ly, *c.*40km NW, Peter O. Meso.
Hirundo smithii			Wire-tailed Swallow
J. 13092	juv.	24.9.68	Kariobangi, Nairobi, Kenya. GCB.
	/?/	18.1.70	Fairview Estate, *near* Kiambu, Kenya, 1°10′S., 36°50′E., *c.*12km N., ly 4m, (F. J. McCartney).
J. 19950	juv.	31.10.68	Kariobangi, Nairobi, Kenya. GCB.
	v	12.2.70	Ruaraka—*near* ringing place, ly 3½m, Mrs. A. Box.
J. 17394	f.g.	6.9.69	Kariobangi, Nairobi, Kenya. GCB.
	v	6.3.70	Lake Hotel, Naivasha, Kenya, 0°45′S., 36°26′E., 6m, 75km NW, P. Bunny.
Riparia paludicola			African Sand Martin
J. 28316	ad.	1.3.69	Lake Nakuru, Kenya. PLB.
	×	1.9.70	Kipsigis Tugen Farm—*near* ringing place, ly 6m, D. a. Towett.
Motacilla alba vidua			African Pied Wagtail
A. 8205	juv.	5.1.70	Lovatelli's Dam, Kabete, Kenya, 1°14′S., 36°45′E., EDS.
	v	2.4.70	Kabete—flew into house, 3m, Mrs. Rowlands.
A. 8211	ad.	5.1.70	Lovatelli's Dam, Kabete, Kenya, EDS.
	×(*wires*)	15.5.70	Jamhuri Park, Nairobi, Kenya, 1°18′S., 36°46′E., 4½m, 7km SSE, P. Ng'ang'a.
A. 8217	ad.	12.1.70	Lovatelli's Dam, Kabete, Kenya. EDS.
	×	29.10.70	Gatundu, Kenya, 1°03′S., 36°54′E., 9m, 30km NE., Cpl. Mulei Nganda.
Motacilla flava			Yellow Wagtail
J. 21575	f.g. ♀	1.11.68	Kariobangi, Nairobi, Kenya. GCB.
	×(*wires*)	9.12.69	Sanyajuu, **Tanzania,** 3°11′S., 37°04′E., ly lm, 215km S., A. Hassani.
J. 11968	ad. ♂ *thunbergi*	5.12.67	Kabete, Kenya (at roost). GCB.
	/?/	2.6.70	*near* Buinsk, Tatarian ASSR, **U.S.S.R.,** 54°48′N., 48°17′E., 2y 6m, (RCM).
J. 22333	f.g. ♀	17.1.69	Kabete, Kenya (at roost) EDS.
	/?/	10.6.70	*near* Bolshie Berezniki, Mordovian ASSR, **U.S.S.R.,** 54°06′N., 45°47′E., ly 7m, (RCM).
J. 35557	ad. ♂ *flava*	9.2.70	Thembigwa, *near* Kiambu, Kenya (at roost), 1°11′S., 36°46′E. GCB.
	/?/	3.8.70	*near* Furmanov, Ivanov Region, **U.S.S.R.,** 57°17′N., 41°07′E. (RCM).
Passer griseus			Grey-headed Sparrow
A. 6579	ad.	27.8.69	Maranda School, Bondo, Kenya, 0°05′S., 34°13′E., JFH.
	×	10.9.70	Nyamira Girls' Primary School, Bondo, A. Omolo.



MAP 1: Showing all recoveries of non-passerines in the Palearctic Region; all were ringed at Lake Nakuru, Kenya.



MAP 2: Showing all recoveries of passerines ringed in East Africa to the Palearctic Region.



MAP 3: Showing sites in East Africa at which birds have been ringed.

TABLE 3

BIRDS RETRAPPED FROM PREVIOUS SEASONS

Calidris ferruginea	2
C. minuta	10
Gallinago gallinago	1
Philomachus pugnax	7
Tringa glareola	5
T. hypoleucos	1
T. stagnatilis	4
Hirundo rustica	5
Motacilla flava	144

KEY TO INITIALS IN LIST OF RECOVERIES

DA	Miss D. Angwin
GCB	G. C. & D. E. G. Backhurst
PLB	P. L. & H. A. Britton
DJMC	D. J. M. Caffyn
HR&W	G. N. Harrington, M. Reid & E. R. Waterhouse
JFH	J. F. & L. M. Harper
RCM	Ringing Centre, Moscow
EDS	E. D. Steel

OTHER RINGERS IN EAST AFRICA

Mrs. L. Campbell	J. F. Reynolds
M. P. L. Fogden	M. & G. Sugg
M. Ford	R. J. Wheater
P. L. Lack	
W. P. Langridge	R. Ziegler

TABLE 4

RECOVERIES IN EAST AFRICA OF BIRDS RINGED ABROAD

The signs and symbols are the same as those used in TABLE 2.

Ciconia ciconia White Stork

Radolfzell BB 14693	pull.	17.6.63	Funfstetten, Kr. Donauworth, Schwaben, **Germany.** 48°50′N., 10°46′E. (F. Frank)
	+	Christmas '69	Mivukoni, Kenya. 0°25′S., 38°15′E. (J. J. Hosman).
Radolfzell *B 51553*	pull.	6.6.66	Agios Vasilios, **Greece.** 40°40′N., 23°07′E. (K. Kussmaul & G. Müller)
	×	1.12.69	Kamaindi, Meru, Kenya. 0°03′N., 37°38′E. (Njagi Mububia Kaburi)
Radolfzell B 56212	pull.	7.6.69	Aratos, **Greece.** 41°05′N., 25°33′E. (G. Müller).
	+ (by tractor)	8.11.69	Timau, Kenya. 0°05′N., 37°15′E. (W. R. Carles).
Radolfzell *BB 12719*	pull.	9.6.69	Bessarios, **Greece.** 39°18′N., 22°08′E. (H. Heckenroth).
	×	2.10.69	Nyandarua, Kenya. 0°37′S., 36°43′E. (Muchiri Gachuru).

Sterna hirundo Common Tern

Radolfzell G 322 705	pull.	18.6.69	Zicksee, Illmitz, **Austria.** 40°46′N., 16°48′E. (R. Triebl).
	× ♀	21.4.70	Maziwi, Tanga, Tanzania. 5°30′S., 39°05′E. (Dr. G. Haas).

Caprimulgus europaeus European Nightjar

London CS 71.066	f.g. ♂	25.9.67	Akrotiri, **Cyprus.** 34°35′N., 32°57′E. (Smithsonian Institution).
	+	6.3.69	Mkolani, Iringa District, Tanzania 7°45′S., 35°40′E. (trapped and killed by an African, reported by J. F. Reynolds).

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(*Received 4th February, 1971*)

Printed by Kenya Litho Ltd., Cardiff Road, P.O Box 775, Nairobi

JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 28 | 5th AUGUST 1971 | No. 124

CYPERACEAE OF EAST AFRICA—V

(Continued from J.E. Afr. nat. Hist. Soc. Vol. xxvi No 1 (113) June 1966

By

D. M. Napper

PYCREUS Beauv.

Like the following genera *Pycreus* has been regarded as a subgenus of *Cyperus* by a number of notable cyperologists. Recent work in related studies, especially anatomy, emphasises the lack of homogeneity in this vast complex and supports the return to a more practicable classification such as is used here.

A large genus spread widely in all tropical and subtropical regions of the world *Pycreus* may be found in most suitably damp localities. Superficially it has a close resemblance to *Cyperus* in the leafy habit and the inflorescence of spikelets borne in ebracteate clusters and umbels. The spikelets themselves are compressed and many-flowered with a persistent but not winged rhachilla. The style bears 2 stigmas and the ellipsoid or obovoid nutlet is laterally compressed (where the stigmas are reduced to 2 in *Cyperus* the nutlets are usually vertically compressed). The surface of the nutlet is smooth except in the section Zonatae where distinct continuous or interrupted horizontal lines or minute tubercles are apparent.

Key to Species

1. Glumes with a deep furrow down each side; stems leafy throughout 2
   Glumes not furrowed; leaves mostly on the lower half of the stem 4
2. Stems creeping at the base, stoloniferous 3
   Stems erect, without stolons . . . . 2. *P. sanguinolentus*
3. Inflorescence with several rays; spikelets ovate, obtuse . . . 1. *P. mundtii* var *mundtii*
   Inflorescence capitate or with 1–3 short rays; spikelets lanceolate, subacute . . . . 1. *P. mundtii* var. *uniceps*
4. Spikelets up to 2.8 mm wide, linear to narrowly lanceolate; glumes up to 3 mm long 5
   Spikelets 3–5 mm wide, oblong to lanceolate; glumes large, 3–4 mm long . . . 23
5. Margins of the glumes very conspicuously white hyaline 6
   Margins of the glumes narrowly hyaline or not distinct 7
6. Spikelets 2–3.5 mm wide; glumes 2.4–3 mm long; nutlets distinctly obovate . . . . 3. *P. albomarginatus*
   Spikelets 1–1.5 mm wide; glumes up to 2.2 mm long; nutlet obovate-oblong . . . . 4. *P. tremulus*
7. Nutlets conspicuously transversely wrinkled or tuberculate 8
   Nutlets smooth or faintly tubercled or very faintly wrinkled 9
8. Glumes yellow; spikelets and bracts spreading; nutlets wrinkled 5. *P. flavescens*
   Glumes orange to dark red-brown . . . . . . 6. *P. rehmannianus*

9\. Spikelets linear, less than 1 mm wide (up to 2 mm in *P. pelophilus*); glumes up to 2.2. mm long 10
Spikelets linear-lanceolate or more broadly linear, 2–3 mm wide; glumes 2.5–3 mm long 20

10\. Glumes up to 1 mm long; slender or very slender annuals 11
Glumes 2 mm long; perennials or annuals 14

11\. Glumes truncate, muticous or with a short mucro . . . . 7. *P. pumilus*
Glumes obtuse or acute but never truncate 12

12\. Inflorescence compound, rays several; spikelets red-brown in lax spikes 10. *P. hildebrandtii*
Inflorescence a simple cluster of sessile spikelets with one very long and 2–3 short bracts, the long erect bract making the head appear lateral . . 13

13\. Spikelets purple-black . . . . 8. *P. melas*
Spikelets light yellowish buff . . . . 9. *P. capillifolius*

14\. Glumes dark brown or black, usually with a green keel 15
Glumes golden or gold and brown, green-keeled 17

15\. Annual; spikelets 5–8 mm long; glumes black, obtuse or subacute with a conspicuous green keel . . . . 12. *P. elegantulus*
Perennials; spikelets 10–20 mm long; glumes brown or black; achenes oblong

16\. Base of stem sheathed in thick black leaf-bases for 1–2.5 cm. roots very thick, about 1.5 mm wide . . . . 13. *P. aethiops*
Base of stem less tightly sheathed, leaves usually diverging from the base; roots moderately thick but less than 1 mm wide . . . . 14. *P. nuerensis*

17\. Spikelets spreading, distant in pendunculate spikes 18
Spikelets erect, very numerous and densely congested; glumes buff or light brown . . . . 15 *P. polystachyos* var. *polystachyos*

18\. Annual . . . . 11. *P. pelophilus*
Perennial 19

19\. Spikelets 1–2 cm long, 1.5 – 2 mm wide, linear-lanceolate; culms stout; leaves 2–4 mm wide . . . . 15. *P. polystachyos* var. *laxiflorus*
Spikelets 1–3 cm long, 1–1.5 mm wide, linear; culms narrow, wiry; leaves 1–3 mm wide . . . . 16. *P. atribulbus*

20\. Perennials; spikelets variously coloured 21
Annuals; spikelets gold and green . . . . 11. *P. pelophilus*

21\. Basal leaf-sheats shredded into coarse fibres . . . . 20. *P. permutatus*
Basal leaf-sheats entire 22

22\. Spikelets yellow or light-brown . . . . 18. *P. lanceolatus*
Spikelets white . . . . 19. *P. smithianus*

23\. Nutlets conspicuously transversely wrinkled or tuberculate 24
Nutlets smooth or minutely pitted 26

24\. Slender annuals; glumes light brown with dark tips . . . . 17. *P. pauper*
Stoutly based perennials 25

25\. Spikes both subsessile and pedunculate together; spikelets brown; nutlet tuberculate . . . . 21. *P. muricatus*
Spikes all subsessile; spikelets black; nutlet wrinkled . . . . 22. *P. macranthus*

26\. Spikelets 2.5–3 mm wide; glumes mucronate; stolons long and slender . . . . 23. *P. longistolon*
Spikelets 3–5 mm wide; glumes muticous, obtuse 27

27\. Glumes black; leaves narrow, folded . . . . 24. *P. nigricans*
Glumes brown or buff; leaves flat 28

28\. Stolons present, long and stout . . . . 25. *P. nitidus*
Stolons never present . . . . 26. *P. unioloides*

1\. *P. mundtii* Nees var. *mundtii*
(*Cyperus mundtii* (Nees) Kunth)

Stoloniferous perennial up to 25 cm (10 ins.) high with thick leafy decumbent stems. Inflorescences bracteate with short or very short branches bearing digitate or shortly

racemose heads of brown spikelets 2–4 mm wide. River banks, swamps and marshy places; sea-level to 1829 m (6000 ft)
KENYA–Masailand, Rift Valley and Nyanza Regions.
TANZANIA–Widespread; Pemba.
UGANDA–Mengo and western regions.

var. *uniceps* (C.B.Cl.) Napper, comb. nov.

(*Cyperus sanguinolentus* var. *uniceps* C.B.Cl. in Engl., *Engl. Jahrb.* 38: 132 (1906), *Cyperus mundtii* (Nees) Kunth var. *uniceps* (C.B.Cl.) Kük.)

Differs in the more slender habit, the contracted inflorescence and the slightly more acute dark spikelets. In swamps and running water, also damp places in forest; 1219–2133 m (4000–7000 ft.)
KENYA–Highlands east of the Rift Valley.
TANZANIA–Widespread on mountains.
UGANDA–Kigezi.

2. *P. sanguinolentus* (Vahl) Nees
(*Cyperus sanguinolentus* Vahl, *C. eragrostis* Vahl)

Herb in dense clumps 15 cm–45 cm (6–18 ins.) high with stems leafy throughout. Inflorescence dense with numerous linear-oblong spikelets 2 mm wide with obtuse dark brown glumes with black keels. Streams, waterholes and saline places; 1066–1676 m (3500–5500 ft).
KENYA–Nairobi district.
TANZANIA–Northern and Central areas.

3. *P. albomarginatus* Nees
(*Cyperus albomarginatus* (Nees) Steud.)

Stout annual up to 30.5 cm (1 ft) high with leaves 5–8 mm wide. Inflorescence of lax pedunculate spikes of oblong-lanceolate orange-brown spikelets. Nutlets obovate-oblong, apiculate. In standing water, swamps and ditches.
KENYA–Nyanza Region.
TANZANIA–Widespread but not common.
UGANDA–Western areas and Soroti.

More slender plants with very narrow leaves found in the Malagarassi Swamps have been described as *C. hochstetteri* Krausss var. *tenuis* Boeck. but the differences are too slight to justify the maintenance of this form.

4. *P. tremulus* (Poir.) C.B.Cl.
(*Cyperus tremulus* Poir.)

Very similar to *P. albomarginatus* but more slender and with much narrower spikelets having narrower erect glumes 1.2–2 mm long, and narrower oblong nutlets. Damp places and in standing water; sea-level to 1219 m (4000 ft).
TANZANIA–Eastern areas from Kilosa to the Pare Mts.
UGANDA–Mengo and eastern areas.

5. *P. flavescens* (L.) Reichenb.
(*Cyperus flavescens* L.)

Densely tufted annual up to 30.5 cm (1 ft) high with short narrow leaves. Inflorescences simple with 3–10 clusters of spikelets which are linear-oblong, 6–10 mm long, with closely overlapping glumes. Swampy grasslands, river banks and forest clearings; 914–1981 m (3000–6500 ft).
KENYA–Central Province and western areas.
TANZANIA–Widespread.
UGANDA–Widespread.

6. *P. rehmannianus* C.B.Cl.
(*Cyperus rehmannianus* (C.B.Cl.) Boeck.)

Slender annual up to 45 cm (18 ins) high with narrow leaves. Spikelets congested in a single head 10-15 mm wide, rarely with rays up to 5 cm long. Glumes subacute, mucronate, chestnut brown with a green keel. Nutlets wrinkled to almost smooth. Damp places on rocky outcrops, woodland and as a weed; 914–2743 m (3000–9000 ft).
KENYA–Nairobi district, central and western highland areas.
TANZANIA–Western and Southern Regions.
UGANDA–Lower slopes of Mt. Elgon.

7. *P. pumilus* Domin
(*Cyperus pumilus* L., *P. patens* (Vahl) Cherm.)

Slender annual up to 22.5 cm (9 ins) high with a few slender leaves and a several-rayed inflorescence of capitate cluster of brown or orange spikelets up to 2.5 mm wide with truncate, mucronate or muticous glumes. Margins of pools, vlei, seepage areas and rock outcrops; sea-level to 1676 m (5500 ft).
KENYA–Central Region and Nairobi.
TANZANIA–Widespread but not abundant; Pemba.
UGANDA–Mengo and western regions.

8. *P. melas* (Ridley) C.B.Cl.
(*Cyperus melas* Ridley, *Pyreus ater* (C.B.Cl.) Cherm.)

Slender annual up to 15 cm (6 ins) high with few slender basal leaves and a single head of up to 15 black spikelets 1.2. mm wide with obtuse glumes and faintly rugose nutlets. Damp places in grassland; 1828–1981 m (6000–6500 ft).
TANZANIA–Central and western areas.
UGANDA–Mt. Elgon.

9. *P. capillifolius* (A.Rich.) C.B.Cl.
(*Cyperus capillifolius* A.Rich.)

Annual similar to *P. flavescens* but more slender. Spikelets only slightly longer than those of *P. melas* but pale. Swamps and grassland; 609–1219 m (2000–4000 ft.)
UGANDA–West Nile and Mengo.

10. *P. hildebrandtii* C.B.Cl.
(*Cyperus pseudohildebrandtii* Kük., *P. minimus* C.B.Cl.)

Densely tufted leafy perennial up to 45.5 cm (18 ins) high with pedunculate heads of red or chestnut linear spikelets. Swampy places and ricefields; sea level to 122 m (400 ft).
KENYA–Coast.
TANZANIA–Tanga to Dar es Salaam; Zanzibar and Pemba.

11. *P. pelophilus* (Ridley) Ridley
(*Cyperus pelophilus* Ridley, *P. sulcinux* of Fl. Trop. Africa not of Fl. Brit. India)

Slender annual 10–30.5 cm (4–12 ins) high with umbellate heads of orange-red or golden linear spikelets 2 mm wide with broadly ovate mucronate glumes. Damp places among grasses, laterite outcrops, stream-banks etc.; sea level to 167 m (56500 ft).
TANZANIA–Uncommon but widely scattered; Zanzibar.
UGANDA–Karamoja, Busoga and Mengo.

12. *P. elegantulus* (Steud.) C.B.Cl.
(*Cyperus elegantulus* Steud.)

Shortly rhizomatous perennial or tufted annual up to 76 cm ($2\frac{1}{2}$ ft.) high with a solitary or several-rayed inflorescence with black spikelets 1–2 mm wide, the glumes

green-keeled, rarely brown with a black margin. Pools and damp grasslands; 914-3200 m (3000-10,500 ft).
KENYA–Widespread and fairly common.
TANZANIA–Widespread, more common in the north.
UGANDA–Widespread.

13. *P. aethiops* (Ridley) C.B.Cl.
(*Cyperus aethiops* Ridley)

Tufted leafy perennial up to 45.5 cm (18 ins) high with a few-rayed inflorescence of dense or elongated spikes with brown linear or linear-lanceolate spikelets 2 mm wide. As a weed.
TANZANIA–Southern Region.

14. *P. nuerensis* (Boeck.) Hooper
(*Cyperus nuerensis* Boeck., *P. globosus* (All.) Reichenb. var. *nuerensis* (Boeck.) Troupin, *C. globosus* All. var. *nuerensis* (Boeck.) Kük.)

A tufted leafy perennial very similar to *P. aethiops* but lacking the very thick roots and thick black base. Glumes and nutlets also similar but the inflorescence much denser. Swamps and ditches; 609–1828–(2000–6000 ft).
KENYA–Kitale district.
UGANDA–West Nile.

15. *P. polystachyos* (Rottb.) Beauv. var. *polystachyos*
(*Cyperus polystachyos* Rottb.)

Tufted plant up to 132 cm (5 ft.) high with very dense clusters of linear-elliptic brown spikelets 1 mm wide. Wet places in grasslands and in rivers.
KENYA–Kisumu district.
TANZANIA–Widespread; Zanzibar and Pemba.
UGANDA–Widespread.

var. *laxiflorus* (Benth.) C.B.Cl.
(*Cyperus polystachyos* var. *laxiflorus* Benth.)

Differs in its more lax inflorescence and its close resemblance to *P. atribulbus*. Wet places in bush and grassland; coastal.
KENYA–Kwale District.
TANZANIA–Dar es Salaam; Zanzibar and Pemba.

16. *P. atribulbus* (Kük.) Napper, comb. nov.
(*Cyperus atribulbus* Kük., Engl. & Diels, *Pflanzenreich iv*, **20** : 363 (1936))

Tufted perennial with thick stem-bases surrounded by the fibrous remains of old sheaths. Inflorescence spreading with pedunculate, elongate heads of linear light brown spikelets 2.5 mm wide. Ditches and swampy grasslands; sea-level to 304 m (1000 ft).
TANZANIA–Korogwe to Southern Region.
Some specimens show an interesting development towards a form of spikelet dehiscence similar to *Queenslandiella*.

17. *P.pauper* (A.Rich.) C.B.Cl.
(*Cyperus pauper* A.Rich., *P. melanacme* Nelmes)

Slender plant up to 45.5 cm ($1\frac{1}{2}$ ft) high, annual with very fine rhizomes and linear leaves. Head of 1–3 oblong-lanceolate spikelets up to 15 mm wide. Swamps and boggy places; 914–1219 m (3000–4000 ft).
TANZANIA–Songea District.
UGANDA–Karamoja.

18. *P. lanceolatus* (Poir.) C.B.Cl.
(*Cyperus lanceolatus* Poir., *Pycreus propinquus* Nees)
Tufted perennial up to 61 cm (2 ft) high with contracted inflorescences of large yellow linear spikelets 3–4 mm wide, lanceolate when young. Damp places, especially on sandy soils; 609–1981 m (2000–6500 ft).
KENYA – Kitale District.
TANZANIA–Western and Southern Regions.
UGANDA–Widespread.

19. *P. smithianus* (Ridley) C.B.Cl.
(*Cyperus smithianus* Ridley)
Tufted rhizomatous perennial with a rosette of leaves and a dense head of white lanceolate spikelets 2–3 mm wide with obtuse or subacute glumes.
TANZANIA–Bukoba District.
UGANDA–Sese Islands.

20. *P. permutatus* (Boeck.) Napper, comb. nov.
(*Cyperus permutatus* Boeck. in *Linnaea* **25**: 477 (1868), *C. macranthus* var. *mucronatus* (Kunth). Kük)
Tufted perennial about 61 cm (2 ft) high with leafy stems surrounded at the base by black or brown coarse hairlike fibres, remnants of the old sheath-bases. Spikelets in dense heads, narrowly oblong-lanceolate, black or brown. Swampy grasslands; 914–2286 m (3000–7500 ft).
KENYA–Western Region.
TANZANIA–Central and western areas.
UGANDA–Widespread.

21. *P. muricatus* (Kük.) Napper, comb. nov.
(*Cyperus muricatus* Kük. in *Fedde Rep.* **12** : 92 (1913), *P. rehmannianus* C.B.Cl. of Fl. Trop. Africa not of Flora Capensis)
Tufted perennial 30.5–76 cm (1–2½ ft.) high, often fibrous coated at the base. Inflorescence of several pedunculate loose spikes of broadly lanceolate spikelets up to 3.5 mm wide, with light golden-brown glumes. Seepage zones, swamps etc.
TANZANIA–Central and southern regions.
UGANDA–Western Region.

22. *P. macranthus* (Boeck.) C.B.Cl.
(*Cyperus macranthus* Boeck.)
Perennial up to 61 cm (2 ft) high with woody rhizomes and stolons. Lower leaf-sheaths often hard and blackish-red: Spikelets oblong-lanceolate, dark brown to ferruginous, 3–5 mm wide with subacute glumes. Swamp grassland; 914–2133 m (3000–7000 ft).
KENYA–Eldoret and Nairobi districts.
TANZANIA–Western, central and southern areas.
UGANDA–Western and central areas.

23. *P. longistolon* (Peter & Kük.) Napper, comb. nov.
(*Cyperus longistolon* Peter & Kük., Engl. & Diels, *Pflanzenreich* **iv, 20** : 333 (1936))
Perennial up to 61 cm (2 ft) high with long slender stolons. Spikelets oblong lanceolate, 2.5–3 mm wide, compressed. Lake shores and damp places in bush; 609–1371 m (2000–4500 ft).
TANZANIA–Lake and Western Regions.

24. *P. nigricans* (Steud.) C.B.Cl.
(*Cyperus nigricans* Steud., *P. nyasensis* C.B.Cl.)
Tufted perennial with persistent black or dark brown leaf-bases, very thick roots and

a dense head of black lanceolate spikelets 5–6 mm wide with green-keeled glumes. In upland and alpine swamps and bogs; 1676–3353 m (5500–11,000 ft).
KENYA–Most highland areas.
TANZANIA–All highland areas.
UGANDA–Kigezi and the Ruwenzori Mts.

25. *P. nitidus* (Lam.) J. Raynal
(*Cyperus nitidus* Lam., *C. lanceus* Thunb., *P. lanceus* (Thunb.) Turrill, *P. umbrosus* Nees)
Woody-based perennial with long stout stolons and simple spreading inflorescence with brown or black spikelets 3–4 mm wide. Swamps and lake shores; 762–2438 m (2500–8000 ft.).
KENYA–Widespread in highland areas above 1524 m (5000 ft).
TANZANIA–Widespread.
UGANDA–Widespread.

26. *P. unioloides* (R.Br.) Urb.
(*Cyperus unioloides* R.Br.)
Tufted perennial without stolons. Inflorescence few-rayed with lanceolate or oblong-lanceolate yellowish or brown shining spikelets 3–5 mm wide and very compressed. Swamps and seasonally flooded grasslands; 914–1981 m (3000–6500 ft).
TANZANIA–Western and southwestern regions.
UGANDA–Widespread.

QUEENSLANDIELLA Domin

A monotypic genus of coastal grasslands and sandy soils, widespread in the tropics as a submaritime weed.

Leafy annual herb with lax spikes of compressed, many-flowered spikelets; the style is bifid and the achene laterally compressed as in *Pycreus* but the glumes are shed together with the rhachilla as in *Mariscus*.

In the key to genera given in part 1 of this series (*J.E.Afr. nat. Hist. Soc.* 24: 2 (106); 3–6 (1963) *Queenslandiela* will key out with *Pycreus*.

Q. hyalina (Vahl) Ballard
(*Cyperinus hyalinus* Vahl. *Mariscopsis hyalinus* (Vahl) Ballard)
Tufted aromatic herb with numerous leaves and long leafy bracts. Spikes lax, pedunculate, with pale golden-brown compressed elliptic spikelets having ovate, scabrid-keeled glumes. Sandy coastal grasslands and as a weed.
KENYA–Coast.
TANZANIA–Coast and Zanzibar Island.
Not unlike small plants of *Mariscus assimilis* but with the pungent odour associated with *M. aristatus*.

MARISCUS Gaertn.

Though regarded by some cyperologists as a subgenus of *Cyperus* since the distinctions between the two are rather narrow and sometimes almost completely break down, they are nevertheless sufficiently important for *Mariscus* to be maintained as a separate genus. Likewise *Pycreus* and *Kyllinga* are distinct, though *Courtoisia*, where the only appreciable morphological difference is in the winged glumes, is here included with *Mariscus*.

In its present connotation *Mariscus* is a large genus and is widespread across the tropical and subtropical regions of the world. As with most cyperaceous genera it is to be

found in damp places and near water, but there is also a large group of species (the section *Bulbocaules*) in which the lower part of the leaf-sheaths form swollen storage organs, an ovate or elongated bulb-like base, the pseudobulb, and these species manage to thrive in semi-arid conditions and crevices of rock outcrops.

Apart from the section *Bulbocaules* mentioned above which comprises about half of the species recorded in East Africa, the leafy perennial or annual habit of most *Mariscus* species differs little from that of *Cyperus*. There is also little difference in the structure of the inflorescence, especially in the species without pseudobulbs. But the spikelets of *Mariscus* are very commonly 1–4-flowered with 3–1 nutlets whereas those of *Cyperus* have many-flowered spikelets. The two genera may be distinguished most easily by differences in the mode of shedding the nutlets; in *Cyperus* it is usual for the glumes and nutlets to be shed progressively as they age until the naked rhachilla alone remains, whereas in *Mariscus* the rhachilla fractures immediately above the lowest pair of glumes and the spikelet is shed entire. Though this is a practical character for separating most species of these two genera, there is a small group of superficially very similar species close to *Mariscus keniensis* and *Cyperus distans* where it needs to be used with caution.

Key to Species

1. Annuals; glumes with recurved tips or awns — 2
   Perennials; rarely annual and the glumes lacking a long recurving tip — 5
2. Stems 30.5–91.4 cm (1–3 ft) tall; leaves 2–5 mm wide with green sheaths; glumes narrowly keeled and winged, acuminate — 3
   Stems short, up to 22.5 cm (9 ins) high; leaves not over 2 mm wide with purplish sheaths; glumes keeled but not winged and with a long subulate awn — 4
3. Spikelets 1–2-flowered, 3–4 mm long; glumes with a straight tip — 2. *M. cyperoides* subbsp. *africanus*
   Spikelets 4–12-flowered, 4–8 mm long; glumes with a recurved tip — 1. *M. assimilis*
4. Glumes 2.5 mm long, compressed; spikes crowded, forming a single hemispheric head — 3. *M. maderaspatanus*
   Glumes 2–2.5 mm long, rounded on the back; spikes cylindric to ovoid-oblong, some of them pedunculate — 4. *M. squarrosus*
5. Stem-bases tuberous or not swollen; leaf-sheaths not semisucculent at the base — 6
   Stem and leaf-bases bulbous-swollen — 20
6. Inflorescence spreading with distant or pedunculate spikes — 7
   Inflorescence a solitary globose head — 28. *M. chrysocephalus*
7. Mature spikelets with 3 or more nutlets (see also *M. sieberianus*) — 8
   Mature spikelets with 1–2 nutlets only — 17
8. Spikelets 1.5–2 mm wide, whitish or sulphur yellow, with or without green keels to the glumes and brownish veining — 9
   Spikelets up to 1 mm wide, red or rust or golden-green or white — 10
9. Spikes ovate to ovate-cylindric, 1–2 cm long; spikelets terete or subterete, 8–20 mm long; glumes not green-keeled, 3–4 mm long — 5. *M. hemisphaericus*
   Spikes cylindric, 2.5–4 cm long; spikelets subcompressed, 6–14 mm long; glumes green-keeled, 4–5 mm long — 6. *M. tomaiophyllus*
10. Glumes conspicuously veined on the back only, sides smooth, tip and margins often scarious, white, red or golden-orange with a green keel — 11
   Glumes very conspicuously veined on the back and sides, red except for the green keel; stems moderately stout from a tuberously swollen base on a woody rhizome — 14. *M. impubes*
11. Glumes 2–3 mm long, whitish or red; inflorescence compound — 12
   Glumes 3.4–5 mm long, often orange-red on the sides; inflorescence simple — 15
12. Glumes whitish except for the green midrib, the veins reaching the entire or emarginate tip, the sides often with hyaline margins — 13
   Glumes black or red except for the midrib, the veins reaching only to the base of the conspicuously hyaline tip — 14
13. Leaves reduced to bladeless sheaths — 7. *M. socialis*
   Leaves with well developed blades — 9. *M. longibracteatus*

14\. Spikelets reddish, 1–1.5 mm wide . . . . 10. *M. rubrotinctus*
Spikelets dark chestnut or black, less than 1 mm wide. . . . 11. *M. keniensis*

15\. Spikes dense with a hairy axis; leaves 2–3 mm wide; bracts 4; rhizome stout, elongated . . . . . . 13. *M. pubens*
Spikes loose with a glabrous axis; leaves 3–8 mm wide, bracts 6–12; plants stoloniferous, rarely merely tufted 16

16\. Glumes greenish white . . . . 8. *M. luteus*
Glumes orange . . . . 12. *M. ferrugineoviridis*

17\. Mature spikes sessile or very shortly pedunculate, simple, 1–2 cm long, 4–15 mm wide 18
Mature spikes pedunculate, usually simple, 1.2–3 cm long, not above 10 mm wide; peduncles at least as long as the spikes 19

18\. Spikes ovoid to shortly cylindric, 1–1.5 cm long, 10–15 mm wide (but narrower if only 1-flowered); glumes 3-4 mm long . . . 15. *M. macrocarpus*
Spikes cylindric 1.5–2 cm long, 4–9 mm wide; glumes 2–2.5 mm long, broader than in the above . . . . 16. *M. macer*

19\. Spikes 15–30 mm long, 5–10 mm wide; spikelets usually 1-flowered but sometimes 2–3 . . . . 18. *M. sieberianus*
Spikes very dense, 5–10 mm long, 3–5 mm wide; spikelets 1-flowered with mucronate glumes . . . . 17. *M. umbellatus*

20\. Heads spreading with pedunculate spikes, or contracted but with distinct spikes . 21
Heads capitate, globose, rarely obscurely lobed 32

21\. Plant pubescent to hairy, or only the glumes pubescent; pseudobulbs with withered keel-less outer sheaths; glumes mucronate 22
Plant and glumes glabrous 23

22\. Pseudobulbs oblong with withered outer sheaths; shortly rhizomatous perennial . . . . 20. *M. psilostachys*
Pseudobulbs ovate with the outer sheaths becoming fibrous; stoloniferous perennial . . . . 21. *M. hirtellus*

23\. Sheaths round the stem-bases without keels, more or less withered and fibrous; spikes pedunculate 24
Sheaths round the stem-bases more or less acutely keeled, usually hard, entire 30

24\. Pseudobulbs short, broadly ovoid . . . . 22. *M. vestitus*
Pseudobulbs narrowly ovoid to cylindric 25

25\. Outer sheaths short, hard, yellow-brown . . . . . 25. *M. amauropus*
Outer sheaths long, membranous, brown or yellow-purple 26

26\. Glumes rust-coloured to red or green 27
Glumes white and rust, spikelets pale 29

27\. Spikelets acute, pale green . . . . 19. *M. phillipsiae*
Spikelets rust or red 28

28\. Spikes 1.5–2 cm long, 8–10 mm wide . . . . 23. *M. taylori* var. *taylori*
Spikes 5–6 cm long, 12–14 mm wide . . . . 23. *M. taylori* var. *groteanus*

29\. Spikes 2 cm long, 15 mm wide . . . . 23. *M. taylori* var. *udigensis*
Spikes 3–5 cm long 6–8 mm wide . . . . 24. *M. rohlfsii*

30\. Spikes ovoid to shortly cylindric, little longer than broad 31
Spikes long cylindric, up to 5 cm long . . . . . . 24. *M. rohlfsii*

31\. Inflorescence spreading with pedunculate spikes . . . 26. *M. obsoletinervosus*
Inflorescence contracted into a subglobose head of sessile spikes 27. *M. pseudovestitus*

32\. Glumes dark red throughout, rarely tipped with white. . . . 29. *M. kerstenii*
Glumes variously coloured, or white variegated with red at the base only . . 33

33\. Glumes variegated 34
Glumes white or yellow or tinged with rust 36

34\. Stem-bases coated with the fibrous remains of old leaves 35
Stem-bases with the entire bases of old leaves . . . . 31. *M.* sp. near *plateilema*

35\. Pseudobulbs cylindric, finely fibrous, scarcely swollen; glume-tips white, often marked with buff . . . . 30. *M. plateilema*
Pseudobulbs ovate; glumes-tips creamy-white . . . . 32. *M. albosanguineus*

36. Glumes bright yellow or brownish 37
Glumes white or cream, rarely pale green 38
37. Spikelets 4–5 mm long, ovate-oblong . . . 33. *M. stramineo-ferrugineus*
Spikelets 5–6 mm long, linear-lanceolate . . . . . 36. *M. remotus*
38. Plants with long slender stolons . . . . . 34. *M. diurensis*
Plants without stolons 39
39. Stems, leaves and bracts pubescent . . . . . 35. *M. albopilosus*
Stems, leaves and bracts glabrous 40
40. Spikelets with 1 nutlet (rarely 2) 41
Spikelets with 2–10 nutlets; bracts not or only slightly dilated at the base . 43
41. Stem-bases coated with fibrous remains of old leaves 42
Stem-bases coated with subentire sheaths; bracts conspicuously dilated at the base . . . . 38. *M. circumclusus*
42. Leaves filiform; heads up to 6 mm long . . . 31. *M. stramineoferrugineus*
Leaves over 1 mm wide; heads 8–16 mm long . . . . 37. *M. mollipes*
43. Heads up to 15 mm diam. 44
Heads 15–20 mm diam. 45
44. Stem-bases coated with entire or subentire sheaths; spikelets with 2–4 nutlets . . . . 39. *M. dubius* var. *dubius*
Stem-bases coated with fibrous remains of old leaves; spikelets compressed, oblong, obtuse . . . . 40. *M. macropus*
45. Stem-bases sparingly or densely coated with fibres; spikelets subcompressed, creamy white . . . . 40. *M. macropus*
Stem-bases coated with subentire sheaths; spikelets subterete, white or greenish white . . . . 39. *M. dubius* var. *macrocephalus*

1. *M. assimilis* (Steud.) Podl.
(*Cyperus assimilis* Steud., *Courtoisia assimilis* (Steud.) C.B.Cl.)
Tufted leafy annual up to 45.5 cm ($3\frac{1}{2}$ ft) high with 3 long leafy bracts. Spikes globose pedunculate 3–8, 8–12 mm diam. with oblong-elliptic compressed spikelets. Heavy seasonally waterlogged soils and by pools; 1066–2133 m (3500–7000 ft).
KENYA–Widespread in western and central areas east to Kibwezi.
TANZANIA–Northern and Lake Regions.
UGANDA–Central and Western Provinces, Mt. Elgon.

2. *M. cyperoides* (Roxb.) Dietr. subsp. *africanus* (Kük.) Podl.
(*Cyperus pseudokyllingioides* Kük., *Courtoisia cyperoides* (Roxb.) Nees)
Tufted annual up to 76 cm ($2\frac{1}{2}$ ft) high differing from the above only in the shorter fewer-flowered spikelets. Seasonally waterlogged places; 762–1676 m (2500–5500 ft).
TANZANIA–Central and Western Regions, also Mahenge.

3. *M. maderaspatanus* (Willd.) Napper, comb. nov.
(*Cyperus maderaspatanus* Willd,. *Sp.Pl.*1; 278 (1797), *Mariscus squarrosus* C.B.Cl. not *Cyperus squarrosus*. L.)
Slender narrow-leaved annual with pinkish purple leaf-bases. Spikes hemispheric, sessile or pedunculate, 10–20 mm diam. with linear spikelets 1 mm wide. Damp places in forest and grassland; sea-level to 762 m (2500 ft).
KENYA–Coast only.
TANZANIA–All eastern areas and the vicinity of Lake Tanganyika; also Zanzibar.

4. *M. squarrosus* (L.) C.B.Cl.
(*Cyperus aristatus* Rottb., *M. aristatus* (Rottb.) Cherm.)
Aromatic small herb with reddish leaf-bases. Spikes ovate to cylindric, sessile and pedunculate, 8–10 mm diam. with linear-oblong spikelets 1–1.5 mm wide. Rocky places in bush and grassland; sea-level to 1981 m (6500 ft).
KENYA – Widespread.
TANZANIA–Widespread but not abundant.
UGANDA–Eastern regions and Mengo.

5. *M. hemisphaericus* (Boeck.) C.B.Cl.

(*M. hemisphaericus* var. *gregorii* C.B.Cl., *Cyperus hemisphaericus* Boeck.)

Coarse tufted plants 30.5–152 cm (1–5 ft) high with tuberous-based stems and 6–10 mm wide flat or pleated leaves with scabrid margins. Heads simple or compound with dense white or light sulphur yellow spikes. Common in damp grasslands on clay soils, forest margins and road-sides; sea-level 1828 m (6000 ft.).

KENYA–Nairobi, Central and Coast Regions.

TANZANIA–Eastern, southern and coastal areas, also Zanzibar and Pemba.

6. *M. tomaiophyllus* (K.Schum.) C.B.Cl.

(*Cyperus tomaiophyllus* K. Schum.)

Stout tufted perennial 30.5–122 cm (1–4 ft) high with flat, scabrid-margined leaves 6–10 mm wide. Heads simple with greenish white or brownish dense spikes. Montaine forest glades, boggy places and moorland; 1828–3048 m, (6000–10,000 ft).

KENYA–All mountain ranges except Cherangani.

TANZANIA–All mountains south of the Uluguru Mts., also Kilimanjaro.

UGANDA–Mt. Elgon. Kigezi.

7. *M. socialis* (C.B.Cl.) Hooper

(*Cyperus socialis* C.B.Cl., *M. trinervius* C.B.Cl.)

Stout rhizomatous perennial 122–182.8 m (4–6 ft.) high. Spikelets spreading, glumes obtuse, 1.7–2 mm long, spreading. Forest fringes; 609–1219 m (2000–4000 ft).

UGANDA–Budongo Forest, Entebbe.

8. *M. luteus* (Boeck.) C.B.Cl.

(*Cyperus luteus* Boeck., *M. foliosus* C.B.Cl.)

Tufted or stoloniferous plants 30.5–106.4 m (1–3½ ft) high with swollen stem-bases. Leaves mostly scabrid-margined. Inflorescence with simple or compound spikes of usually crowded linear greenish spikelets up to 1 mm wide; glumes 3.4–5 mm long. Swamps and forests; sea-level to 2438 m (8000 ft).

KENYA–Sokoke forest, Mt. Elgon.

TANZANIA–Coast, Kilimanjaro and Kigoma areas.

UGANDA–Mt. Elgon and western areas.

Of the material included in this species the up land specimens commonly have a contracted inflorescence with spreading spikelets, while the coastal ones have a spreading inflorescence with somewhat reflexed spikelets. These latter plants may not be distinct from the Madagascan *M. splendens* Cherm., though the glumes are rather smaller than in that species.

9. *M. longibracteatus* Cherm.

(*Cyperus longibracteatus* (Cherm.) Kük., and var. *subdistans* Kük., *C. distans* of Fl. Trop. Afr. in part)

Tufted plants 30.5–76 cm (1–2½ ft) high with the stems swollen at the base. Stolons absent. Bracts 4–8 and very long, usually over 25 cm. Inflorescence compound with dense hemispheric spikes 2.5 cm diam. having 6–12-flowered greenish spikelets. Glumes 2.5–3 mm long. Damp ground and near water in grassland and shady places; 152–1981 m (500–6500 ft).

KENYA–Coastal regions.

TANZANIA–Widespread but not common.

UGANDA–Central and Western Provinces.

10. *M. rubrotinctus Cherm.*

(*C. distans* of Fl. Trop. Afr. in part, C. *longibracteatus* var. *rubrotinctus* (Cherm.) Kük.)

Very close to the above but usually smaller with 7–10 shorter bracts and denser

inflorescences of reddish spikelets. Swamps, river banks and damp ground in plantation crops; sea-level 2286 m (7500 ft).
KENYA–Widespread.
TANZANIA–Northern and western regions.
UGANDA–Kampala and the west.

11. *M. keniensis* (Kük.) Hooper
(*Cyperus keniensis* Kük. as '*keniaeensis*', *C. distans* var. *niger* C.B.Cl.)
Stout perennial up to 61 cm (2 ft) high. Bracts 3–5. Umbels compound with fairly dense spikes of subcompressed spreading spikelets up to 2 cm long. Very like *Cyperus distans* but more robust, the spikelets darker and the glumes longer. Forest, grassland and rivers; 609–2438 m (2000–8000 ft).
KENYA–Widespread.
TANZANIA–Uluguru Mts., and north-eastern areas.
UGANDA–Mt. Elgon and Kigezi.
This, with the preceding two species, was included by C.B. Clarke in the Flora of Tropical Africa under *Cyperus distans* to which all three are superficially very similar but, which normally sheds the glumes and retains the rhachilla of the spikelet. Detailed field observations on all these species is needed for a full understanding of their relationships.

12. *M. ferrugineoviridis* (C.B.Cl.) Cherm.
(*Cyperus maranguensis* var. *ferrugineoviridis* C.B.Cl., *Cyperus ferrugineoviridis* (C.B.Cl.) Kük. including var. *luteiformis* Kük. in part)
Stout perennial up to 91.4 cm (3 ft) high with tuberous stem-base and numerous thick stolons. Inflorescence with long rays and lax ovate cylindric spikes with spreading linear spikelets 12–25 mm long, 1 mm wide, having orange green-keeled glumes with narrow hyaline margins. Damp grasslands and forest clearings, a weed; 1066–2133 m (3500–7000 ft).
KENYA–Upland areas west of the Rift Valley.
TANZANIA–Kondoa and Iringa regions.
UGANDA–Busoga, Kampala and western areas.

13. *M. pubens* (Kük.) Podl.
(*Cyperus pubens* Kük.)
Plants 30.5–61 cm (1–2 ft) high with long woody rhizomes coated with brown sheaths. Stems hairy below the inflorescence. Inflorescence simple with 4–7 pedunculate spikes 1.5–2 cm diam., with narrow linear subterete spikelets having distant glumes. Woodland and forest.
TANZANIA–Southern Highlands and the Lupa Forest Reserve.

14. *M. impubes* (Steud.) Napper, comb. nov.
(*Cyperus impubes* Steud., *Syn. Pl. Glum.* **2:** 45 (1855), *M. richardi* Steud., *M. procerus* A.Rich. not of Nees)
Thick creeping rhizome with tuberous nodes. Stem 45.5–91.4 cm ($1\frac{1}{2}$–3 ft) high. Inflorescence simple with 6–10 pedunculate cylindric spikes 10–12 mm wide. Grassland 1219–2286 m (4000–7500 ft.)
KENYA–Rift Valley, Central Region and Kajiado district, also Cherangani.
TANZANIA–Serengeti Plains.
The inflorescence of this species is very similar to *Mariscus taylori* but the rhizome is distinctive.

15. *M. macrocarpus* Kunth
(*Cyperus macrocarpus* (Kunth) Boeck.)
Rhizomatous plant up to 61 cm (2 ft) high with tuberous stem-bases. Inflorescences of 10–12 subsessile or shortly pedunculate cylindric brownish green spikes of 3–4 glumes.

Savanna, woodland, damp places and as a weed; 762–2133 m (2500–7000 ft).
KENYA–Widespread.
TANZANIA–Widespread in the north.
UGANDA–Widespread but not common.

16. *M. macer* Kunth
(*Cyperus macer* (Kunth) K.Schum.)
Slender plant similar to the above but with 4–7 sessile or subsessile cylindric greenish spikes of usually 1-flowered spikelets. Dry bushland and rocky hills; 1066–1524 m (3500–5000 ft).
KENYA–Turkana & West Pokot.
TANZANIA–North-western areas only.
UGANDA–Karamoja.

17. *M. umbellatus* (Rottb.) Vahl
(*Cyperus subumbellatus* Kük.)
Tufted plant similar to *M. macrocarpus* but smaller. Inflorescence of dense yellow-green spikes of small 1-flowered spikelets up to 2.5 mm long. Rocky hills, grassland, rain-forest etc.; 152–2138 m (500–7000 ft).
KENYA–Rift Valley and Western areas.
TANZANIA–Widespread in northern areas.
UGANDA–Mengo and Busoga, also the Ishasha Forest.
The name used here, and by which this plant has hitherto been known is unfortunately erroneous, but until this whole group of species is fully revised the correct name remains in doubt.

18. *M. sieberianus* Steud.
(*Cyperus cyperoides*(L.) O.Ktze, *M. sublimus* C.B.Cl.)
Tufted perennial 22.5–76 cm (9 ins–2½ ft) high. Inflorescence usually simple of 5–14, long pedunculate, cylindric spikes with spreading spikelets or the lower ones reflexed, and usually 1-flowered, rarely more. Grasslands, bush, swampy places and sometimes as a weed; 304–2133 m (1000–7000 ft).
KENYA–West of the Rift Valley, rarely in the eastern upland areas.
TANZANIA–Widespread.
UGANDA–Widespread.
A particularly large form of this species was distinguished as *C. nossibeensis* Steud. but the differences are so slight as to make the two virtually indistinguishable.

19. *M. phillipsiae* C. B. Cl.
(*Cyperus phillipsiae* (C.B.Cl.) Kük.)
Tufted perennial 30.5–61 cm (1–2 ft) high with cylindric swollen stem-bases. Inflorescences similar to small forms of *M. umbellatus* but the glumes and spikelets are very acute. Savanna, forest glades and as a weed; sea level to 762 m (2500 ft.)
KENYA–Coast north of Mombasa.

20. *M. psilostachys* C.B.Cl.
(*Cyperus psilostachys* (C.B.Cl.) Kük.)
Tufted perennial up to 39.5 cm (1 ft) high with narrowly oblong or ovoid pseudobulbs having the scarious remains of old leaf-sheaths. The whole plant normally hairy, though a glabrous state may be occasionally found. Inflorescence of simple pedunculate spikes up to 1.5 cm long with spreading terete spikelets having conspicuously recurved glumes. Rocky outcrops in open woodland and grassland; 1066–2133 m (3500–7000 ft).
KENYA–Rift Valley, northern and western areas.
TANZANIA–Throughout western and central regions, also the Usambara Mts.
UGANDA–Central and Eastern Provinces, also Karamoja.

21. *M. hirtellus* Chiov.
(*Cyperus hirtellus* (Chiov.) Kük.)
Similar to the above but with several stout stolons. *Brachystegia* and *Isoberlinia* woodlands; 914–1219 m (3000–4000 ft).
TANZANIA–Central and Western Regions.

22. *M. vestitus* (Krauss) C.B.Cl.
(*Cyperus vestitus* Krauss)
Tufted or stoloniferous plants up to 15 cm (6 ins) high with ovoid pseudobulbs. Spikes 4–5, dense, with subterete spreading red spikelets. Rocky outcrops and in stony, sandy savanna; 1219–1828 m (4000–6000 ft.).
KENYA–Widespread in suitable habitats.
TANZANIA–Throughout Masailand and the Usambara Mts.
UGANDA–Ankole.

23. *M. taylori* C.B.Cl. var. *taylori*
(*Cyperus oblongo-incrassatus* Kük.)
Tufted plants with or without stolons, stems up to 61 cm (2 ft) high with membranous sheaths coating an oblong-cylindric pseudobulb. Inflorescence of simple pedunculate cylindric spikes with subterete oblong-lanceolate spikelets 1.5 mm wide. Rocky scrub and grassland; sea-level to 1828 m (6000 ft).
KENYA–Rift Valley and Eastern Regions to the Chyulu Hills.
TANZANIA–E. Usambara Mts. and Handemi District.

var. *groteanus*(Kük.) Napper, comb. nov.
(*Cyperus oblongo-incrassatus* var. *groteanus* Kük., Engl. & Diels, *Pflanzenreich iv*, **20:** 550 (1936))
Differs in its greater stature and broader spikelets. Rocky places; 914–1219 m (3000–4000 ft).
TANZANIA–East Usambara Mts.

var. *udigensis* (Kük.) Napper, comb. nov.
(*Cyperus oblongo-incrassatus* var. *udigensis* Kük., Engl. & Diels, *Pflanzenreich iv* **20 :** 550 (1936))
Differs in the very pale inflorescences and short, wide spikes.
KENYA–Coast.
TANZANIA–Sigi River.

24. *M. rohlfsii* (Boeck.) C.B.Cl.
(*Cyperus rohlfsii* Boeck., *C. procerus* var *rohlfsii* (Boeck.) Kük., *C. oblongo-incrassatus* var *clarior* Kük.)
Tufted plant with hard, keeled or subterete leaf-bases covering the pseudobulb, and long thick stolons. Inflorescence of 5–8 pedunculate pale or red-brown spikes with terete spikelets less than 1 mm wide and up to 3 mm long. Dry bush; 304–1371 m (1000–4500 ft).
KENYA–Widespread in dry bushland areas.
TANZANIA–Lake Natron.

25. *M. amauropus* (Steud.) Cuf.
(*Cyperus amauropus* Steud., *M. leptophyllus* C.B.Cl. *M. concinnus* C.B.Cl. not of Schrad.)
A very variable plant 15–45.5 cm (6–18 ins). high with the pseudobulbs covered with tough, rarely keeled leaf-bases, sometimes stoloniferous. Leaves up to 2 mm. wide. Inflorescence of 3–5 pedunculate rather lax spikes of 6–12 reddish compressed spikelets up to 10 mm long, rarely more. Rocky outcrops and stony soils in grassland and bush;

457–2133 m (1500–7000 ft).
KENYA–Widespread.
TANZANIA–Widespread in the north of the country.
UGANDA–Widespread in dry areas, especially Karamoja.

26. *M. obsoletinervosus* (Peter & Kük.) Greenway
(*Cyperus obsoletivervosus* Peter & Kük as *obsoletenervosus*)

Robust tufted plants, usually stoloniferous. Inflorescence similar to the above, but the spikelets more numerous, terete and paler. Dry bush; 304–609 m (1000–2000 ft).
KENYA–Machakos District and Tsavo National Park.
TANZANIA–Umba Steppe.

27. *M. pseudovestitus* C.B.Cl.
(*Cyperus pseudovestitus* (C.B.Cl.) Kük.)

Robust tufted plant without stolons, sheathing leaf-bases purplish, dark, keeled. Inflorescence of 3–4 dense spikes sessile in a dense head or very shortly pedunculate with terete spikelets similar to the above but broader, 1.5–2.5 mm wide. Rocky outcrops and stony hillsides in dry grassland and bush; sea level to 1981 m (6500 ft).
KENYA–Widespread.
TANZANIA–In the northern half of the country only.
UGANDA–Karamoja.

28. *M. chrysocephalus* K.Schum.
(*Cyperus chrysocephalus* (K.Schum.) Kük.)

Tufted plant 30.5–61 cm (1–2 ft) high with black, usually wiry-fibrous sheathing bases only slightly swollen; leaves rigid, linear. Inflorescences a solitary brilliant yellow globose head of 8–10 mm diam. Swamps, dambos and peat bogs; 1219–1676 m (4000–5500 ft).
TANZANIA–Western and Southern Highland areas.

29. *M. kerstenii* (Boeck.) C.B.Cl.
(*Cyperus kerstenii* Boeck.)

Stout tufted perennial up to 61 cm (2 ft) high, the elongated pseudobulbs covered with many-ribbed coriaceous sheaths. Leaves 3–7 mm wide. Bracts scabrous margined. Head capitate, dark red, 1–2.5 cm diam., dense and more or less distinctly 3-lobed, rarely with distinct lateral heads. Mountain moorland; 2590–4266 m (8500–14,000 ft).
KENYA–Aberdare Mts., Mt. Kenya, West Pokot.
TANZANIA–Mt. Meru & Kilimanjaro.
UGANDA–Elgon, Dabasien.
More slender plants from the upper bamboo *Hagenia* forest of Mt. Kenya and Kilimanjaro which were given the name *M. karisimbiensis* Cherm. var. *longinux* (Kük.) Kük. are probably no more than reduced plants of *M. kerstenii*.

30. *M. plateilema* Steud.
(*Cyperus plateilema* (Steud.) Kük.)

Tufted plant 15–38 cm (6–15 ins) high with cylindric slightly swollen stem-bases often coated with fine fibres. Leaves narrow. Bracts 2–4 dilated at the base. Heads variegated blackish red and white, from almost all white to almost all black. Spikelets crowded, 5–8 mm long; glumes 4–8 mm long. Mountain streams and damp moorland and forest; 1828–3658 m (6000–12000 ft).
KENYA–Mt. Elgon.
TANZANIA–Kilimanjaro.
UGANDA–Mt. Elgon, Kigezi.

31. *M.* sp. near *M. plateilema*

Tufted plant up to 45.5 cm ($1\frac{1}{2}$ ft) high with ovate to oblong pseudobulbs and 2 mm wide leaves. Heads more or less distinctly lobed with 3–4 bracts dilated at the base and purple-black spikelets with white tips. Swampy grassland, stream banks etc.; 1981–3048 m (6500–10,000 ft).
KENYA–Mt. Elgon and the Narok District.
UGANDA–Karamoja, Mt. Elgon and the Western Region.

32. *M. albosanguineus* (Kük.) Napper, comb. nov.
(*Cyperus albosanguineus* Kük.)

Tufted plant rarely over 25 cm (10 ins) high, with ovate pseudobulbs. Heads globose, not lobed, 9–14 mm diam. Spikelets with small dark red lower glumes and white or variegated upper ones 3–4 mm long. Damp grassland and moorland; 1676–3353 m (5500–11,000 ft).
KENYA–Chyulu Hills, Narok and Naivasha Districts to Laikipia.
TANZANIA–Kilimanjaro and mountains in Masailand and western regions.
UGANDA–Mt. Elgon and Karamoja.

33. *M. stramineoferrugineus* (Kük.) Napper, comb. nov.
(*Cyperus stramineoferrugineus* Kük. in Engl. & Diels, *Pflanzenreich*, **iv,** 20 : 550 (1936)

Tufted plant to 25 cm (10 ins) high with ovate-oblong pseudobulbs densely covered with dark brown fibres. Head 6–10 mm diam. with spikelets up to 5 mm long; glumes subobtuse. Grassland; 1219–1981 m (4000–6500 ft).
TANZANIA–Usaramo.

34. *M. diurensis* (Boeck.) C.B.Cl.
(*Cyperus diurensis* Boeck.)

Erect stems up to 30.5 cm (1 ft) high growing singly on a long slender stolon, pseudobulbs cylindric with paper sheaths. Leaves very long, up to 4 mm wide. Heads 12–18 mm wide with ovate-oblong spikelets 3 mm wide. Grassland and *Brachystegia* woodland, sandy soils; sea level to 1371 m (4500 ft).
KENYA–Sokoke Forest.
TANZANIA–Central and western areas, widespread but not common.
UGANDA–West Nile.

35. *M. albopilosus* C.B.Cl.
(*Cyperus albopilosus* (C.B.Cl.) Kük.)

Pseudobulbs short with scarious outer sheaths, crowded on a short rhizome. Stems, leaves and bracts pubescent. Heads white, globose, 6–10 mm diam. Uncommon in savannah and grassland 914–1828 m (3000–6000 ft).
KENYA–Kitale District.
TANZANIA–Songea District.

36. *M. remotus* C.B.Cl.
(*Cyperus remotus* (C.B.Cl.) Kük.)

Tufted plant up to 61 cm (2 ft) high with ovate pseudobulbs rarely with a few outer fibres. Heads globose, lemon yellow, 10–15 mm diam. with terete spikelets up to 8 mm long and subacute glumes. Damp places in grassland; 1524–2133 m (5000–7000 ft).
KENYA–Widespread west of the Rift Valley.
TANZANIA–Masailand.
UGANDA–Karamoja.

37. *M. mollipes* C.B.Cl.
(*Cyperus mollipes* (C.B.Cl.) K.Schum.)
Tufted plant up to 15–30 cm (6 or 12 ins) high with ovate to ovate-oblong pseudobulbs surrounded by a dense mat of fibrous remains of the outer sheaths. Heads white, globose, 8–15 mm diam. Grassland and woodland; sea-level to 1676 m (5500 ft).
KENYA–Coast to Kajiado District, Isiolo and Turkana.
TANZANIA–Widespread
UGANDA–Karamoja, Ankole.

38. *M. circumclusus* C.B.Cl.
(*Cyperus circumclusus* (C.B.Cl.) Kük.)
Tufted plant up to 45.5 cm (1½ ft) high with ovate oblong pseudobulbs rarely becoming fibrous coated as in *M. mollipes*. Bracts conspicuously dilated at the base. Heads white with acute spikelets. Grassland; 304–2138 m (1000–7000 ft).
KENYA–Widespread.
TANZANIA–Widespread in the centre and the north.
UGANDA–Widespread in the west and in Busoga District.

39. *M. dubius* (Rottb.) Hutch.
(*Cyperus dubius* Rottb.)
Slender tufted plants up to 30.5 cm (1 ft.) high with ovate pseudobulbs covered with membranous old brown sheath-bases. Leaves 2–4 mm. wide. Heads ovoid, white or greenish white, dense, 8–16 mm long, up to 12 mm diam. Rocky places, limestone cliffs, acid soils and grassland; sea level to 1838 m (6000 ft).
KENYA–Mara Plains and the coast.
TANZANIA–Widely scattered in northern, coastal and southern regions; Zanzibar Island.
UGANDA–Murchison Falls National Park.

var. *macrocephalus* (Boeck.) Chiov.
(*Cyperus dubius* var. *macrocephalus* Boeck.)
A stouter plant than the above, up to 45.5 cm (1½ ft) high with with ovoid-cylindric pseudobulbs and leaves 4–8 mm wide. Heads greenish white, lobed, 15–20 mm diam. Rocky places, grassland and woodland; sea-level to 1828 m (6000 ft).
KENYA–Widely scattered in semi-arid areas.
TANZANIA–Widely scattered in central and northern areas; Zanzibar.
UGANDA–Karamoja and Ankole.

40. *M. macropus* C.B.Cl.
(*Cyperus submacropus* Kük.)
Tufted plant up to 30.5 cm (1 ft) or more high with oblong pseudobulbs covered in a brown fibrous mat. Head off-white or greenish, subglobose, 10–25 mm diam. with wide spikelets having few to 12 glumes. Swampy places and forest glades; sea-level to 1371 m (4500 ft.)
KENYA–Coast, and widely scattered inland.
TANZANIA–Widely scattered in northen and central areas, and Usaramo.
UGANDA–Widely scattered.
Occasionally exceptionally robust forms occur. These have been described under the name *C. submacropus* var. *calocephalus* Kük. but in the apparent absence of supporting characters this variety does not seem to be worth maintaining.

KYLLINGA Rottb.

This is the third of the major genera which have been included by Boeckeler, Kükenthal and others in *Cyperus*. It has a similar distribution to *Pycreus* and *Mariscus*.

Both the annual and perennial members of this genus commonly make very leafy tufts, though there are a number of perennial species which throw up single often distant stems from a horizontal rhizome. It seems that under different ecological conditions some species, which normally produce rhizomes with well-spaced nodes and distant stems, may produce forms with a more compact rhizome bearing more closely approximated stems. The inflorescence has one to many bracts at the base and consists of a sessile head comprising one or more dense globose or shortly cylindric spikes. The spikelets are 1–6-flowered with 2 empty glumes at the base followed by one or more bisexual fertile florets and usually one or more sterile glumes at the top. The nutlets are oblong to ellipsoid, laterally compressed and smooth; the style has 2 stigmas.

Key to Species

1. Glumes dark red, with or without a green keel; perennial up to 36 cm high with swollen stem-bases . . . . . . 22. *K. pulchella*
   Glumes white or variously coloured 3

2. Glumes yellow, golden or brown, rarely green 2
   Glumes white or very pale straw-coloured or very pale green 16

3. Keel of the glumes conspicuously winged; glumes light brown or gold 4
   Keel of the glumes rounded or acute, rarely very obscurely winged 5

4. Annual; keel of the glume with a deeply incised wing . . . . 1. *K. squamulata*
   Perennials with the stems thickened at the base and usually covered with fibrous remnants of the old leaf-sheaths; keel of the glumes dentate or serrate . . . . 2. *K. alata*

5. Stems not conspicuously thickened at the base 6
   Stems conspicuously thickened at the base, often bulbous 9

6. Spikelets lanceolate, 4–4.5 mm long; stems tufted or on a short rhizome; spikes loose with few spikelets . . . . 10. *K. pauciflora*
   Spikelets oblong-elliptic, 2.5–3.5 mm long; culms distant on a long rhizome; spikes dense with many spikelets 7

7. Glumes rust-coloured with a green often spinulose keel 8
   Glumes golden or rust-coloured tinged with black, keel not spinulose 9. *K. aurata* var. *lurida*

8. Bracts long and flaccid, spreading or reflexed; glumes yellowish or whitish green on the sides . . . . 8. *K. colorata*
   Bracts short and rigid with one usually stiffly erect . 9. *K. aurata* var. *aurata*

9. Stem-bases covered with the entire or tufted remains of the outer leaf-sheaths; plants tufted 10
   Stem-bases coated with entire, short, bladeless sheaths; plant rhizomatous . . . 12

10. Glumes with a long mucro 11
    Glumes obtuse; spikelets 3–4.5 mm long; central spike ovate to subcylindric, yellow . . . . 23. *K. chrysantha*

11. Spike solitary, ovate to cylindric, 5–8 mm wide, greenish when young with the glumes becoming black at the tip . . . . 6. *K. nervosa*
    Spike narrowly cylindric, 4–5 mm wide, rarely more but then with 1–2 small lateral spikes at the base, golden or brownish gold . . . . 7. *K. flava*

12. Bracts 2–4; stems slender, crowded on a long rhizome; heads greenish or golden 15. *K. erecta*
    Bracts 4–8 or more; stems stout, usually distant but sometimes approximate, rarely crowded 13

13. Stout plants with a stout rhizome bearing distant erect stems; head cylindric, usually greenish gold or brownish . . . . . 11. *K. elatior*
    Moderately stout plants with the stems more crowded on the rhizome; heads globose to ovoid 14

14. Bracts 4–5, usually short and rigidly reflexed but sometimes longer and flexous; heads golden or brownish . . . . . . 13. *K. melanosper*
    Bracts very numerous, 5–11, spreading or reflexed 15

15. Rhizomes stout with short internodes and dark purple leathery, usually shining bracts 1–1.5 cm long; heads golden . . . . . 12. *K. elata*
    Rhizome bearing swollen stem-bases with pale or purplish bracts not over 1 cm long; stems leafy; heads pale green or yellowish green . . . 14. *K. polyphylla*

16. Keel of the glumes conspicuously winged, at least in the middle; spikes solitary . 17
Keel of the glumes not winged; spikes 1–3 19

17. Stems distant on a long rhizome; stem-bases not swollen . . 5. *K. nemoralis*
Stems crowded; stem-bases bulbous or tuberous 18

18. Stems slender or stout, tufted and surrounded at the base by fibrous remnants of old leaf-bases, but these not always conspicuous . . . . . 3. *K. alba*
Stems stout, rather crowded on a creeping woody rhizome . 4. *K. cartilaginea*

19. Stem-bases swollen, bulbous tuberous or a stout rhizome 20
Stem-bases not swollen 25

20. Leaves and bracts pubescent to almost tomentose . . . . 25. *K. platyphylla*
Leaves and bracts glabrous, occasionally with ciliate margins 21

21. Stolons present, slender; stem-bases surrounded by old leaf-sheaths . 24. *K. bulbosa*
Stolons absent 22

22. Stem-bases covered with short bladeless sheaths, crowded on a creeping rhizome . 23
Stem-bases surrounded by the short fibrous remnants of old leaves . . . 24

23. Rhizome unbranched straight, the stems crowded in almost straight lines; glumes mucronate . . . . 15. *K. erecta*
Rhizome much branched and the stems appearing tufted; glume-tips attenuate, obtuse to subacute . . . . 16. *K. crassipes*

24. Leaves 2–5.5 mm wide, flaccid, flat . . . . 26. *K. comosipes* var. *comosipes*
Leaves 1–2.5 mm wide, more rigid, folded . . . 26. *K. comosipes* var. *angustata*

25. Central spike less than 4 mm wide, shortly cylindric to ovoid; plants tufted, stem-bases fibrous-coated 26
Central spike 4–12 mm wide; plants stoloniferous or rhizomatous . . . 27

26. Keel of the glumes obscurely winged, ciliate . . . . 19. *K. welwitschii*
Keel of the glumes neither winged nor keeled . . . . 20. *K. microstyla*

27. Central spike globose or ovoid 28
Central spike cylindric 30

28. Tufted annual or perennial without stolons or rhizomes . . . 17. *K. pumila*
Rhizomatous or stoloniferous perennial 29

29. Stems distant on a slender rhizome . . . . . . 8. *K. colorata*
Stems tufted, slender stolons usually present . . . . . 24. *K. bulbosa*

30. Glumes up to 2 mm long, broadly ovate, subacute; spike narrow up to 5.5 mm wide . . . . 21. *K. odorata* var. *odorata*
Glumes 3–4 mm long, lanceolate; spike 6–9 mm wide 31

31. Lateral spikes absent; glumes broadly lanceolate, white . . . 18. *K. triceps*
Lateral spikes present; glumes lanceolate, acuminate, white with a conspicuous green keel . . . . . . 21. *K. odorata* var. *major*

1. *K. squamulata* Vahl

(*Cyperus metzii* (Hochst.) Mattf. & Kük.)

Tufted annual up to 30 cm high though usually much less, with solitary green to light brown subglobose spikes 6-10 mm diam. of numerous ovate 1-flowered spikelets 2.5–4 mm long. Damp places in grass and bushland, sometimes as a weed; 762–1371 m (2500–4050 ft).

TANZANIA–Lake and Southern Regions.

UGANDA–Central and Eastern Provinces.

2. *K. alata* Nees

(*Cyperus alatus* (Nees) F. Meull., *K. alba* Nees var. *alata* (Nees) C.B. Cl.)

Tufted perennial with an aromatic base differing from *K. alba* in its smaller size, narrower leaves and yellow-green head. Spike solitary, ovate-globose or oblong-cylindric with broadly ovate spikelets and acute glumes. Damp places in grassland, especially on sandy soils and around rock outcrops; 1066–1676 m (3500–5500 ft).

KENYA–Northern Region.

TANZANIA–Common in the north-west.

3. *K. alba* Nees
(*Cyperus cristatus* (Kunth) Mattf. & Kük.)
Tufted perennial up to 30.5 cm (1 ft) high with aromatic base and solitary off-white globose spikes with lanceolate-elliptic spikelets and subacuminate glumes. In dry areas, grassland, open bushland and on rock outcrops; 457–2590 m (1500–8500 ft).
KENYA–Apparently widespread, but rarely collected.
TANZANIA–Widespread.
UGANDA–Karamoja.

4. *K. cartilaginea* K. Schum.
(*Cyperus cartilagineus* (K. Schum.) Mattf. & Kük.)
Stout perennial with thick creeping rhizome and closely set stems up to 38.1cm (15 ins) high with solitary globose-ovate spikes up to 10 mm diam. and oblong-elliptic spikelets having unequal obtuse, narrowly winged glumes. Coastal forest and bushland; sea-level to 914 m (3000 ft).
KENYA–Coastal.
TANZANIA–Coastal and central regions; also Zanzibar.

5. *K. nemoralis* (Forst.) Hutch.
(*Cyperus kyllingia* Endl.,*K. monocephala* Rottb. in part)
Small creeping perennial with widely spaced stems up to to 38.1cm (15 ins) high and solitary whitish globose or ovate spikes 4–6 mm wide with ovate-elliptic spikelets 2–2.5 mm long, the glumes terminating in a long curved mucro. Clearing in rain- and swamp-forests; 457–1219 m (1500–4000 ft).
TANZANIA–East Usambara Mts.
UGANDA–Western and Central Provinces.

6. *K. nervosa* Steud.
(*Cyperus costatus* Mattf. & Kük.)
Small tufted perennial to 22.5 cm (9 ins) high with swollen, fibrous-coated often aromatic stem-bases having a solitary ovate to shortly cylindric spike 5–8 mm wide; spikelets broadly ovate, 1–2-flowered, 2–3 mm long with awned glumes becoming blackish especially on drying. Grassland and savanna, often on rock pavements; 762–2133 m (2500–7000 ft).
KENYA–Elgon, Nairobi and Central Regions, also Masailand.
TANZANIA–Widespread in the northern half of the country.
UGANDA–Ankole.

7. *K. flava* C. B. Cl.
(*Cyperus oblongus* (C. B. Cl.) Kük., *K. ruwenzoriensis* C.B. Cl.)
Tufted fibrous-coated perennial with stems rarely exceeding 30.5 cm (1 ft) high and solitary cylindric golden yellow spikes 10-12 mm long, 4–5 mm wide with 1–2 small lateral ones; spikelets ovate with ovate-elliptic glumes having a green wingless ciliate keel and a subulate mucro. Damp places in savanna and swamps; sea-level to 1524 m (5000 ft).
KENYA–Northern and eastern areas, also the coast.
TANZANIA–Masailand to the Uluguru Mts.
UGANDA–Ruwenzori Mts.
The winged glumes of *K. alata* separate the occasional plant with rather elongated heads from *K. flava*, and the small lateral spikes help to separate young plants from *K. nervosa.*

8. *K. colorata* (L.) Druce
(*Cyperus brevifolius* (Rottb.) Hassk., *K. brevifolia* Rottfb., *Schoenus coloratus* L.)
Creeping perennial with the habit of *K. nemoralis* and *K. aurata;* spikes solitary ovate or ovate-globose, 4–8 mm long with lanceolate-oblong spikelets; the glumes

whitish with a green, often spinulose keel, long recurved mucro and long flaccid bracts. Roadsides, damp places and swamps in grassland and forest clearings; 76–1828 m (250–6000 ft).
KENYA–Nyanza and Central Regions.
TANZANIA–Frequent in the north-east and the north.
UGANDA–Central and western areas.

9. *K. aurata* Nees var. *aurata*
(*Cyperus erectus* (Schumach.) Mattf. & Kük... var. *auratus* (Nees) Kük.)
Perennial with creeping rhizome and distant erect stems up to 45.5 cm (18 ins) high; spikes usually solitary, ovate or ovate-globose, 4–8 mm wide with 3–4 short, rigid bracts of which one is almost always stiffly erect; spikelets elliptic to lanceolate-oblong with subulate-tipped glumes having a green often spinulose keel. Damp places in grassland, by roads, in swamps and as a weed; 76–1828 m (250–6000 ft).
KENYA–Nyanza and Central Regions.
TANZANIA–Frequent in the north, rare in the south.
UGANDA–Widespread, but not recorded in Karamoja.
This is easily confused with *K. nemoralis*, which however has whitish winged glumes, and with *K. colorata* which is a more leafy plant with long soft drooping bracts and whitish spikes.

var. *lurida* (Kük.) Napper, comb. nov.
(*Cyperus erectus* (Schumach.) Mattf. & Kük. var. *luridus* (Kük.) Kük. *Kyllinga erecta* Schumach. var. *lurida* Kük. in *Notizbl. bot. Gart. Berl.* **9**: 300 (1925))
Spikelets ovate-lanceolate with golden or rust-coloured obscurely veined glumes tipped with black. Grassland; 1371–2590 m (4500–8500 ft).
KENYA–Central and Rift Valley Regions.
TANZANIA–Not uncommon in the north, more rare towards the south.

10. *K. pauciflora* Ridl.
(*Cyperus ridleyi* Mattf. & Kük.)
Tufted perennial with short creeping rhizome and solitary globose spikes of 6–12 yellow to brown spikelets having green-keeled subulate-tipped glumes. Grassland and savanna; 914–1524 m (3000–5000 ft).
TANZANIA–South-western and southern areas.

11. *K. elatior* Kunth
(*K. pinguis* C. B. Cl. in part, *Cyperus aromaticus* (Ridl.) Mattf. & Kük. var *elatior* (Kunth) Kük.)
Perennial herb with long stout rhizome with distant erect culms with purplish bracts at the base, differing from *K. melanosperma* chiefly in the greater robustness, the longer internodes and the cylindric head. Damp places in grassland and forest, also in swamps; 1066–1981 m (3500–6500 ft).
KENYA–From the Aberdare Mts. and Mt. Kenya to Nairobi and Machakos.
TANZANIA–Widespread throughout the country but not recorded from the Southern Region.
UGANDA–Central and Western areas.

12. *K. elata* Steud.
(*Cyperus aromaticus* (Ridl.) Kük. var. *elatus* (Steud.) Kük.)
Perennial herb similar to *K. elatior* but with shorter interndes to the rhizomeo and dark purple, leathery, often shining bracts. Involucral bracts 5–11, long and flexuous, or short and stiffly reflexed; spike solitary or with small laterals, gold or whitish. Stieam banks and swamps; sea-level to 1219 m (4000 ft).
KENYA–Coast.
TANZANIA–Songea, Ruaha National Park, Uluguru Mts. and the coast; also Zanzibar and Pemba.

13. *K. melanosperma* Nees
(*Cyperus melanospermus* (Nees) Suringar)

Perennial herb with straight or contorted rhizome and crowded rigid culms with purplish bracts. Spike solitary, ovoid or globose with 4–5 short, rigidly reflexed or long flexuous bracts. Swamps, damp grassland and stream-banks; 1066–2286 m (3500–7500 ft).
KENYA–Kitale and Mt. Elgon.
TANZANIA–Serengeti, Njombe and the Mbosi Districts.
UGANDA–West Nile and Busoga Districts.

14. *K. polyphylla* Kunth
(*Cyperus pinguis* (C. B. Cl.) Mattf. & Kük., *K. pinguis* C.B. Cl. in part)

A variable perennial with stout creeping rhizome and crowded stems. Spikes ovate to globose with 5–8 bracts and oblong-elliptic spikelets 2.5–3.5 mm long; glumes ovate to ovate-lanceceolate mucronate. Grassland, moist savanna, swamps, streamsides, dams etc.; sea level to 914 m (3000 ft).
KENYA–Coastal regions and Mt. Elgon.
TANZANIA–Central, Southern and Coastal Regions, rare in the West. The rigid forms of this species may be readily confused with *K. elata*.

15. *K. erecta* Schumach.
(*Cyperus erectus* (Schumach.) Kük.)

Slender perennial herb with creeping rhizome coated with pale or purplish sheaths and erect stems up to 30.5 cm (1 ft.) high swollen at the base; spike solitary, globose to ovate-globose, 4–8 mm diam. 2–4 short reflexed bracts and ovate-lanceolate spikelets. Swampy grassland; 914–1981 m (3000–6500 ft).
KENYA–Nairobi and Western Region.
TANZANIA–Southern Region.

16. *K. crassipes* Boeck.
(*Cyperus bulbipes* Mattf. & Kük.)

Perennial herb with short creeping aromatic rhizome having purplish sheaths, and crowded bulbous-based stems up to 30.5 cm (12 ins) high; spike solitary, globose, 4–8 mm wide. Woodland, riversides, and as a weed in badly drained ground; sea-level to 1371 m (4500 ft).
KENYA–Widely scattered in the east, also in the Central Region.
TANZANIA–Widely scattered especially in the east; Zanzibar Island.
UGANDA–Widespread.

17. *K. pumila* Michx.
(*Cyperus densicaespitosus* Mattf. & Kük.)

Tufted annual or perennial up to 61 cm (2 ft) high with greenish heads having reflexed bracts noticeably widening at the base; centre spike ovate to subcylindric with 2 small lateral ones; glumes shortly mucronate with spinulose green keels. In swamps and near water; 762–1371 m (2500–4500 ft).
KENYA–Central Region.
TANZANIA–Widespread but not common.
UGANDA–Western areas and Mengo, nowhere common.

18. *K. triceps* Rottb.
(*Cyperus triceps* (Rottn.) Endl.)

Rhizomatous perennial up to 38.1 cm (15 ins) high with white or off-white heads of 3–1 spikes, the central spike subcylindric to cylindric, up to 1 cm long with 3–3.5 mm

long spikelets. Grassland and shady places; sea-level to 1828m (6000 ft).
KENYA–Western Region.
TANZANIA–Northern and Lake Regions, also Southern Region.
UGANDA–Karamoja.

19. *K. welwitschii* Ridley
(*Cyperus triceps* (Rottb.) Endl. var. *ciliata* (Boeck.) Kük. in part, *K. triceps* Rottb. var. *ciliata* Boeck.)
Small tufted perennial up to 22.5 cm (9 ins) high, with swollen stem-bases and off-white heads of 3 spikes, the centre one ovate to ovate-oblong. Damp hollows in bushland; 304–1524 m (1000–5000 ft).
KENYA–Turkana.
UGANDA–Karamoja.

20. *K. microstyla* C.B. Cl.
(*Cyperus microstylus* (C.B. Cl.) Mattf & Kük.)
Small tufted perennial up to 15 cm (6 ins) high with the habit of *K. welwitschii* but smaller spikelets and scarcely keeled glumes. Open bushland; up to 457 m (1500 ft).
KENYA–Tsavo National Park.

21. *K. odorata* Vahl var. *odorata*
(*Cyperus sesquiflorus* var. *cylindricus* (Nees) Kük.)
Very variable shortly rhizomatous plant up to 30.5 cm (1 ft) high with creamy-white heads of 3–4 spikes, the central one 4–6.5 mm wide, and broadly ovate spikelets not over 2 mm long. Grassland, savanna, swamps, etc.; 914–1981 m (3000–6500 ft).
KENYA–Western Region.
TANZANIA–Lake, Western and Southern regions.
UGANDA–Widespread.

var. *major* (C.B. Cl.) Chiov.
(*Cyperus sesquiflorus* var. *major* (C.B. Cl.) Kük., *K. cylindrica* Nees var. *major* C.B. Cl.)

Tufted perennial up to 45.5 cm (18 ins) high, stout; central spike cylindric to ovate, up to 1.2 cm long and 9 mm wide with ovate-oblong spikelets 4–4.5 mm long; glumes long acuminate. Grasslands, forests and shady places; 1524–3048 m (5000–10,000 ft), rarely lower.
KENYA–Widespread.
TANZANIA–Widespread.
UGANDA–In all upland areas.

22. *K. pulchella* Kunth
(*Cyperus teneristolon* Mattf. & Kük., *C. transitorius* Kük.,*K. anomala* Kük.)
A very variable tufted or shortly rhizomatous perennial up to 45.5 cm (18 ins) high with long slender stolons; heads dark red with a cylindric central spike 6–10 mm wide and small usually sessile lateral spikes; spikelets with ovate-lanceolate mucronate glumes and 2–3 nutlets.
KENYA–Mt. Elgon, Rift Valley and the Nairobi area.
TANZANIA–Scattered localities in the northern half of the country.

23. *K. chrysantha* K. Schum.
(*Cyperus aureostramineus* Mattf. & Kük.)
Tufted perennial up to 30.5 cm (12 ins) high with slender stolons and golden-yellow heads with an ovate or subcylindric central spike up to 9 mm long. Damp places in grassland; 1066–1676 m (3500–5500 ft).
KENYA–Western Region.
TANZANIA–Western Region and in the vicinity of Lake Victoria.
UGANDA–Western Region near Lake Victoria.

24. *K. bulbosa* P. Beauv.

(*Cyperus richardii* Steud., *K. macrocephala* A. Rich., *K. sphaerocephala* Boeck.)

Rhizomatous perennial with long slender stolons and stems up to 30.5 cm (1 ft) high. Heads of 3–1 spikes, the central one ovate to subcylindric, 6–11 mm wide and the lateral ones smaller; glumes ovate-lanceolate, often purple-dotted. Grassland and damp places generally; 914–2590 m (3000–8500 ft).
KENYA–Widespread.
TANZANIA–Widespread in the west of the country.
UGANDA–Widespread except in the north.

25. *K. platyphylla* K. Schum.

(*Cyperus ciliato-pilosus* Mattf. & Kük.)

Densely tufted perennial up to 22.5 cm (9 ins) high with fibrous-coated stem-bases and hemispheric cream heads of 3–1 spikes. Woodland and grassland; 1066–1524 m (3500–5000 ft).
TANZANIA–In the south and south-west.

26. *K. comosipes* (Mattf. & Kük.) Napper, comb. nov. var. *comosipes*

(*Cyperus comosipes* Mattf. & Kuk. in Engl. & Diels, *Pflanzenreich* **iv**, 20: 568 (1936), *K. leucocephala* Boeck. not of Baldwin)

Tufted perennial up to 45.5 cm (18 ins) high with a solitary globose spike 6–12 mm wide and oblong-elliptic spikelets each with 2–4 nutlets. Grassland and bushland, usually in damp depressions; 609–1828 m (2000–6000 ft).
KENYA–Nairobi and Central Region.
TANZANIA–Widespread, often common in central regions.
UGANDA–Mengo.

var. *angustata* (Peter & Kük.) Napper, comb. nov.

(*Cyperus cartilagineus* var. *angustatus* Peter & Kük. in Engl. & Diels, *Pflanzenreich* **iv**, 20: 609 (1936)).

Differs from the species in its more slender habit, much narrower leaves and light brown fibrous base to the tuft; heads small and usually distinctly compound. Damp places in grassland and thicket woodland; 914–2133 m (3000–7000 ft).
TANZANIA–Central regions from Shinyanga to Iringa District.
UGANDA–Karamoja.

(Received 1st March 1971)

Published by The East Africa Natural History Society, Box 4486, Nairobi, Kenya and printed by Kenya Litho Ltd., Box 40775, Nairobi.

JOURNAL OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 28 10th AUGUST 1971 No. 125

THE FOOD OF THE BARN OWL IN THE SERENGETI NATIONAL PARK, TANZANIA,

by

W. A. Laurie

INTRODUCTION

The object of this study was to obtain information about the prey of the Barn Owl (*Tyto alba*, Scopoli), by identification of skulls in their regurgitated pellets and to compare the prey taken in different habitats. Differences in the contents of the pellets from various habitats may be due to differences in abundance of the prey species or differences in selection by the predator. The latter could be due to different vegetation cover or different hunting methods or a combination of both. Attempts were made to determine any prey selection by comparing the pellet contents with a small number of trapping records. Neither trapping nor pellet collection provide an unselective sampling method but comparison of the two can give some idea of the type of selection taking place. Other predators select in different ways; a number of droppings of the Genet (*Genetta genetta*, Linnaeus) were also examined for comparison with the owl pellet data.

Methods

The work was done in some of my spare time as a field assistant in the Serengeti Research Institute of the Serengeti National Park, Tanzania. Collections of pellets were made in the large granite outcrops or kopjes near Seronera, between 11th May and 31st July 1969—a very dry period. All pellets were from roosting sites at which Barn Owls had been seen. There were three main sites of collection:—

Site No. 1: Oloserian, the site of the Serengeti Research Institute buildings 3.219 km (*two miles*) from Seronera. At least one pair of Barn Owls were resident in a large rock outcrops during the study period but no new pellets were found after the beginning of July. The group of rock outcrops and buildings are situated in sparse acacia woodland east of Seronera.

Site No. 2: Masai Kopjes, a large group of thickly vegetated outcrops 8.047 km (*five miles*) south-east of Seronera on the border of the open plains and the woodlands. Barn Owls were disturbed on four different roosts and new pellets were found under one or more of them at each collection.

Site No. 3: Simba Kopjes, another group of large rock outcrops, 32.187 km (*twenty miles*) south-south-east of Seronera in the open plains. The vegetation is very like that of Masai Kopjes but slightly sparser. Two definite Barn Owl roosts were found here. The similarity to

Site No. 2 means that these two can be compared jointly as plains sites with Site No. 1, a woodland site.

439 pellets, together with a quantity of disintegrated pellet material were collected from these three localities and all lower jaws and skulls present were dissected out. These were identified to genera with the aid of "Keys to the Genera of Insectivora, Chiroptera and Rodentia of East Africa" by J. B. Foster and A. Duff-Mackay, and by subsequent comparison with specimens at the British Museum, London in December 1969. The bird skulls were not identified, nor were the only reptile remains—a lizard's lower jaw.

The wing and body cases of beetles were present in many pellets. These were not identified, nor was it possible to estimate the numbers of beetles contributing to the remains present in any one pellet. However, each pellet was recorded as containing or not containing beetle remains and the results of this analysis are shown below.

Genet droppings were collected on several occasions from a large rock near Oloserian. The skulls in these droppings were broken up to a considerable degree and not many reliable identifications could be made. Lower jaws, however, were found intact and their identification as far as the orders Insectivora and Rodentia was possible.

A little mammal trapping was done at Oloserian with Longworth traps. These were deliberately placed to attempt to catch a large variety of species; consequently numbers of those trapped by no means reflect the relative abundances of the small nocturnal mammals which would be available to the owls.

Results

	Site No. 1 Oloserian		*Site No. 2 Masai*		*Site No. 3 Simba*		*Total*	
	No.	*% Tot.*	*No.*	*% Tot.*	*No.*	*% Tot.*	*No.*	*% Tot.*
RODENTIA:								
Arvicanthis	24	6.8	145	17.8	22	20.4	191	15.1
Mastomys	58	16.8	52	6.4	12	11.1	122	9.7
Saccostomus	36	10.4	61	7.5	6	5.6	103	8.2
Steatomys	22	6.4	30	3.7	6	5.6	58	4.6
Zelotomys	1	0.3	12	1.6	0		13	1.0
Mus	4	1.2	9	1.1	0		13	1.0
Thallomys	3	0.8	9	1.1	0		12	0.9
Pelomys	2	0.6	1	0.1	0		3	0.2
Tatera	0		0		3	2.6	3	0.2
Tachyoryctes	1	0.3	0		0		1	0.1
INSECTIVORA:								
Crocidura	181	52.4	466	57.3	57	52.8	704	55.6
Elephantulus	3	0.8	0		0		3	0.2
CHIROPTERA:								
Tadarida	2	0.6	1	0.1	0		3	0.2
Taphozous	1	0.3	1	0.1	0		2	0.1
BIRDS	8	2.3	25	3.1	2	1.9	35	2.8
REPTILES	0		1	0.1	0		1	0.1
TOTALS	346	100.0	813	100.0	108	100.0	1267	100.0
BEETLES	37	34.0	178	62.0	23	53.0	238	54.0
NO BEETLES	73	66.0	108	38.0	20	47.0	201	46.0
TOTALS	110	100.0	286	100.0	43	100.0	439	100.0

Notes: Species were identified as follows:—

Mus minutoides (Smith)
M. bufo (Thomas)
Crocidura bicolor (Bocage)
Elephantulus rufescens (Peters)
Tadarida aegyptiaca (E. Geoffroy)
Taphozous (Liponycteris) nudiventris (Cretzschmar)

Trapping results: The following were captured in a total of 70 trap days in the rock outcrops at Oloserian.

Acomys spp.	20
Arvicanthis spp.	16
Mastomys spp.	13
Lemniscomys spp.	1
Graphiurus spp.	1
Crocidura spp.	4

Genet droppings: Few positive identifications could be made; the numbers of insectivores are compared with the number of rodents (lower jaws), from 43 droppings.

Rodentia:	23 (inc. *Arvicanthis, Steatomys* and *Mastomys* spp.)
Insectivora:	3 (probably *Crocidura* spp.)

Discussion

Various significant differences can be seen between the contents of pellets from different sites. The most obvious are between those from Oloserian and the other two sites. Oloserian has a significantly lower percentage of *Arvicanthis* and higher percentages of *Mastomys, Saccostomus* and *Steatomys*. Oloserian also has a very much lower percentage of pellets containing beetle remains. Some genera are completely absent in the samples from a particular locality; for example, *Tatera* is present only in the smaller sample of Simba, and *Elephantulus* was found only at Oloserian.

As stated earlier these differences could be caused by a difference in the small mammal populations or by differences in sampling or by a combination of both. The habitat differences between sites 2 and 3 are slight and this is reflected in the similarity of the pellet contents from these sites. The details of the way in which the habitat differences affect the small mammal populations require an extensive knowledge of the habitat preferences of the animals involved. Differences in sampling by the owls could result from the longer grass and thicker tree cover round the rock outcrops in the woodland and the presence of human habitation at Oloserian could also be involved.

From the trapping results, it can be seen that the identification of owl pellet remains gave no true picture of the small mammal population: three genera were trapped for which no remains were found in pellets at any site. *Acomys*, the spiny mouse, has the posterior dorsal hairs modified into rigid spines which could discourage owls (and genets) from eating or capturing them. *Graphiurus*, the dormouse, is presumably protected by its arboreal habits. *Arvicanthis* features prominently in trap data and they were often seen during daytime in the area although occuring as rather a low percentage in the pellets from Oloserian. Possibly they are protected from owl predation by their largely diurnal habits.

The very high proportion of insectivores in the owl pellets compared with their almost non-existence in the genet droppings is noteworthy. Many carnivores (domestic cats, foxes and jackals) are known to dislike shrews but it seems that owls have no such dislike.

Acknowledgements

I would like to thank all those who have made this study possible and especially Dr. H. F. Lamprey for the opportunity of working in the Serengeti Research Institute, to A. Duff-Mackay for some preliminary identifications at the National Museum, Nairobi, to Dr. Corbett for permission to use the reference collections of mammals at the British Museum (Natural History) and to Miss Ingles and Mr. Hill. (both also of the British Museum) for their help in identification. I would like to thank Dr. H. Kruuk for his advice throughout and for reading and commenting on the manuscript.

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(Received *4th January, 1971*).

JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 28 15th AUGUST 1971 No. 126

NOTES ON THE DISTRIBUTION OF *HOLODACTYLUS AFRICANUS* BOETTGER

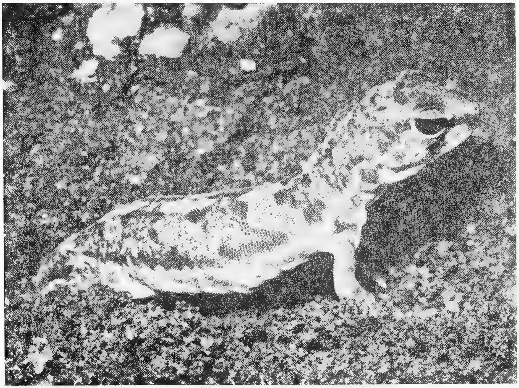
By

R. C. Drewes

California Academy of Sciences

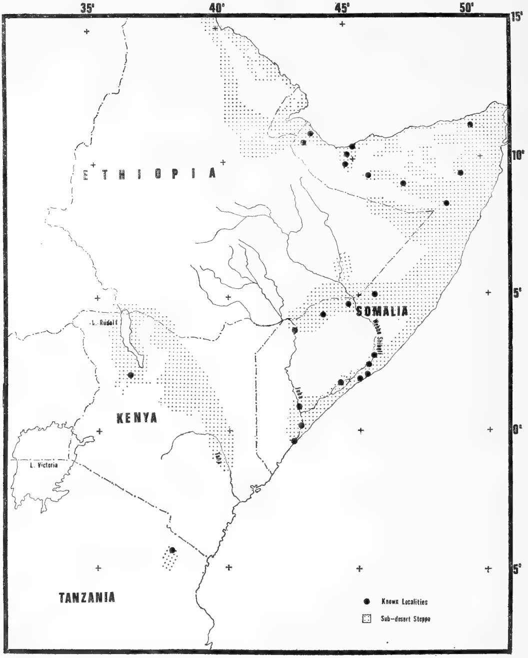
Research Associate, National Museums of Kenya

Holodactylus africanus Boettger occupies a unique position as the only East African eublepharine gecko and one of only two found on the African continent. Its range has been given as Ethiopia and British Somaliland, south through Somalia to Kenya (Loveridge, 1947, 1957). In regard to Kenya, I have been unable to find any heretofore published localities within Kenya, or, indeed, within political East Africa.



Holodactylus africanus (CAS 125431) emerging from burrow, Mkomazi, Tanzania.

During the period June 29 to July 14, 1968, a collection of lizards was made in the Lokori area, Turkana District, Kenya, by the South Turkana Expedition of the Royal Geographical Society. The specimens were sent to the British Museum (Natural History) and identified by E. N. Arnold. Among them was *Holodactylus africanus* (personal communication; specimen not seen by author).



Map of East Africa showing extent of sub-desert steppe and localities at which *Holodactylus africanus* has been found. Somalia localities not found: Caitoi; Negelli; and Gumboworen. *Note:* Ethiopian locality listed in Loveridge (1947) as "Abdulla" is located in Somalia, just south of the Ethiopian border and west of Webbe Shibeli.

On January 7, 1970, at approximately 8:00 am, following a period of heavy rain, a sub-adult male *Holodactylus africanus* was collected by Dr. E. S. Ross of the California Academy of Sciences at Mkomazi, Tanzania [4°38″ S, 38°05″ E] (CAS 125431). This is the first record of the genus in Tanzania and represents a considerable range extension to the south. The animal was found emerging from a burrow it had dug in lateritic soil about 6 metres (20 feet) from a termite mound and was photographed *in situ* by Dr. Ross. (Plate).

CAS 125431, which is 78 mm in length (58 mm s.v.+20 mm tail), agrees closely with the description given by Loveridge (1947) for *Holodactylus africanus*. Five termites (*Bellicositermes* [=*Macrotermes*: Termitidae]) were found in the stomach.

The distribution of *H. africanus* seems to agree with that of a particular sub-desert steppe vegetation type which is dominated by widely spaced *Commiphora* and *Acacia* of low stature, with *Salvadora* and *Leptadenia pyrotechnica* (Forsk.) Decne also characteristic. Sub-desert steppe is usually bordered by large areas of wetter wooded steppe composed of more closely spaced *Acacia* and *Commiphora* with grasses of one metre in height, and is apparently transitional between wooded steppe and true desert (Keay, 1959). It extends as a continuous coastal belt with inland extensions from Chisimaio, Somalia, north beyond the Rift Valley in Ethiopia. Isolated areas of this vegetation type exist around Lake Rudolf, south-east along the Tana River to near Bura, Kenya, and in the vicinity of the Usambara Mountains of north-east Tanzania.

Based on available data, all specimens of *Holodactylus africanus* have been found in scattered localities within the sub-desert steppe described, and it seems likely that the animal may be expected in suitable habitats *throughout* the sub-desert steppe. It has not been recorded from west of the Rift Valley (the Kenya locality, according to Gwynne [1969], is on the Rift Valley floor), suggesting that the Rift acts as a physiographic barrier to westward expansion. However, west and north of the Rift extensive sub-desert steppe areas which border the Sahara are poorly known, and *Holodactylus* may eventually be found there.

I suggest that *Holodactylus* probably evolved in the arid sub-desert areas of northern East Africa. At one time it may have had a more extensive range, but subsequent fluctuations in moisture have led to the isolation of populations existing in remnant sub-desert steppe habitats in north-central Kenya and north-eastern Tanzania.

The origins of *Holodactylus* are obscure, for the genus does not appear to be closely allied to any extant group. Indeed, Kluge (1967) suggests that the differences between *Holodactylus* and *Hemitheconyx*, the only other African eublepharine, point to separate evolutionary lines.

ACKNOWLEDGEMENTS

I wish to thank the following for their assistance: Dr. Alan E. Leviton, Theodore J. Papenfuss, and Dr. Edward S. Ross of the California Academy of Sciences, and Dr. M. D. Gwynne of the Royal Geographical Society, London.

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(*Received 2nd April, 1971*).

Published by The East Africa Natural History Society, Box 44486, Nairobi Kenya and printed by Kenya Litho Ltd., Box 40775, Nairobi.

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JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 29 8th OCTOBER 1971 No. 127

OBSERVATIONS ON REPRODUCTION, AESTIVATION AND POLYMORPHISM IN THE SNAIL, *LIMICOLARIA MARTENSIANA* (SMITH) FROM THE QUEEN ELIZABETH NATIONAL PARK, UGANDA.

By

NASAR A. DIN

Nuffield Unit of Tropical Animal Ecology, Queen Elizabeth National Park, Uganda

The land snail, *Limicolaria martensiana* (Smith) (Pulmonata-Achatinidae) is widely distributed in the Queen Elizabeth National Park, Uganda which lies in the western limb of the Rift Valley. The snail exists in five different polymorphic forms described as Streaked, Pallid 1, Pallid 2, Pallid 3 and Broken-streaked or Pallid 4 (Owen 1966, 1969). The frequency of polymorphic forms both in the living and fossil sites at Kichwamba and Kabazimu Island in Lake Edward have been described by Owen. The fossils date from 8,000 to 10,000 years old when widespread volcanic activity took place in the area and killed the snails as well as other animal life (Owen 1963). Owen (1964, 1967) has also described the occurrence of bimodal breeding peaks correlated with a biannual pattern of rainfall in this species in other areas; and aestivation during drought leading to the production of live young. All of the published work on the snails from the Park was carried out by Owen south of the Equator and was related to polymorphic forms. The purpose of the present study was to investigate further the aestivating behaviour of snails and to establish variations in the frequency of the different polymorphic forms in the previously undescribed northern part of the Park.

The present study area was a scattered forest of the *Euphorbia dawei* N.E.Br. trees (30° 05′E, 0° 07′N) used by Pink-backed Pelicans (*Pelecanus rufescens* Gmelin) and Marabou Storks (*Leptoptilos crumeniferus* (Lesson)) for nesting. The ground under the forest is covered with clumps of the bushes of *Capparis tomentosa* Lam. and *Securinega virosa*. (Roxb. ex Willd.) Baill. The snails were normally found on the ground in the shade of the bushes or feeding on the leaves. No living snails were found in the open patches of grass between the bushes although shells of dead snails were common. The surrounding vegetation of the forest consists largely of open savanna grassland of *Imperata cylindrica* (L) Beauv. studded with *Capparis* bush and *Acacia* trees. Further description of the vegetation in and around the forest is given by Din (1970). Attention was focused on a small area in the northern section of the forest 85×85m in extent. Usually two samples (sometimes one), each consisting of four quadrats (1 sq. m) were taken within the sample area. The bush and ground vegetation had to be cleared before taking the sample. The snails were stored in a large Kilner jar and transported to the laboratory for examination. The snails were boiled until dead and the body removed from the shell

with a needle. At times the columella adhered to the body in which case the shell had to be broken piecemeal with a thin pair of forceps until the body could be released. Eggs or young were conspicuous in the uterus but they were counted after rupturing the uterus. The eggs varied in coloration from pale yellow to white. The results are shown in Table 1.

Date	A	NA	Total	%A	Ground	Mean Rainfall (mm)
10. 1.69	45	160	205	22.0	Dry	Jan., 35.0
24. 1.69	4	293	297	1.3	Wet	
7. 2.69	1	215	216	0.5	Wet	Feb., 30.0
6. 3.69	1	347	348	0.3	Wet	
14. 3.69	0	224	224	0.0	Wet	Mar., 100.0
21. 3.69	0	249	249	0.0	Wet	
2. 4.69	345	0	345	100.0	Dry	April., 110.0
17. 4.69	2	195	197	1.0	Dry	
7. 5.69	0	154	154	0.0	Wet	May, 95.0
23. 5.69	0	158	158	0.0	Wet	
6. 6.69	0	65	65	0.0	Wet	June, 30.0
16. 6.69	48	40	88	54.5	Dry	
27. 7.69	100	0	100	100.0	Dry	Jul., 20.0
30. 7.69	10	73	83	12.0	Dry	
6. 8.69	123	0	123	100.0	Dry	Aug., 50.0
14. 8.69	48	60	108	44.4	Dry	
4. 9.69	1	52	53	1.9	Wet	Sept., 60.0
22. 9.69	0	62	62	0.0	Wet	
6.10.69	0	82	82	0.0	Wet	Oct., 95.0
22.11.69	0	80	80	0.0	Wet	Nov., 92.0
3.12.69	34	72	106	32.1	Dry	Dec., 70.0
Total	762	2,581	3,343	22.8	—	—

TABLE 1. The number of Aestivating (A) and Non-Aestivating (NA) snails in the *Euphorbia dawei* forest near Kamulikwezi in Queen Elizabeth National Park.

From the table it is clear that snails aestivate when the weather is dry. Before aestivating a thin layer of mucus is secreted over the mouth of the shell. When the weather is wet snails come out of their aestivation and begin to move about. The duration of the period of aestivation in the snail population could not be estimated accurately due to irregular sampling but they may go into aestivation even within a rainy season if dry periods exist. It is not clear what factors stimulate the snail to terminate its aestivation but according to Owen (1967) it is probably the pressure in the uterus of live young produced while the parent is still in aestivation—an 'internal synchronisation' correlated with the onset of the dry season. In the case of adult or immature snails which do not have eggs or young in the uterus, the termination of aestivation remains obscure. In the north of the Park, the two wet and two dry seasons in a year are well marked although variations in the amount of rainfall may occur from one year to another. In the sampled population aestivation was observed during the dry season of December and January but some rain during February prevented further aestivation. March, April and May are usually rainy months and sudden aestivation observed during April (2.4.1969) was again probably related to a short dry spell. The second dry season of June, July and August was observed to cause some aestivation in the snails but no aestivation was noticed, as expected, during the next wet season i.e. September, October, and November. It is thus concluded that aestivation is correlated with alternation of wet and dry seasons but short spells of drought during a wet season may also cause aestivation.

Out of a total of 3,343 snails sampled 1,305 (39%) were classed as mature i.e. $\geqslant$ 4.0 cm in length and 2,038 (61%) as immature. The mean clutch size of 114 gravid snails examined was found to be 12.5 (6 = 4.5). The clutch size given by Owen (1967)

in a population near Kampala was 9.2 ($n = 54$). Although both populations exist near the Equator, a larger clutch size in the former may be due to abundance of food and its undisturbed habit.

Using Owen's (1969) terminology for polymorphic forms 897 snails examined showed four distinct patterns consisting of Streaked (42.5%), Pallid 1 (34.9%), Pallid 2 (13.6%) and Pallid 3 (9.0%). The fifth form, Broken Streaked was absent from the population. This form is generally rare and Owen (1969) has noted its presence at very low frequencies in only three of the Park populations he sampled. Further, in the population near the Equator road, only Streaked (44.4%) and Pallid 1 (55.6%) forms were present. In the Kamulikwezi population under study at a distance of 17 km from the Equator road population, there are significant differences and the two populations are separate. The frequency of polymorphic forms is related to the density of snails in any one area and not to habitat. The Streaked form was found by Owen (1965) to be high in populations which were least dense, and low in populations which were dense. In populations with densities more than 100 per sq. m. the Pallid forms were present but in populations with less than 20-30 per sq. m the Pallid forms were almost rare. In the present study, at an average density of 52 per sq. m, the Streaked and Pallid 1 forms were the most common. Other than the four distinct polymorphic forms present, there are various intermediate patterns which were left unclassified.

The total area in which the snails live is 1.945×10^8 ha (750,000 sq. m) and harbours a population of about 42 million snails. This appears to be the largest discrete population from Uganda. The next biggest being from 70 to 80 thousand described by Owen (1967) in an area of 8.945×105 ha (3,450 sq. m) near Kampala.

ACKNOWLEDGEMENTS

I am most grateful to Dr. S. K. Eltringham, Director of Nuffield Unit of Tropical Animal Ecology in Queen Elizabeth National Park who kindly read the manuscript and offered valuable advice whilst the paper was in preparation.

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(Received 27th April, 1971).

Printed by Kenya Litho Ltd., P.O. Box 40775, Cardiff Road, Nairobi.

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JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

Vol. 29 5th NOVEMBER 1971 No. 128

A NEW HYPEROLIUS (AMPHIBIA ANURA) FROM KENYA

By

A. DUFF-MACKAY

The National Museum of Kenya

and

ARNE SCHIØTZ

Danmarks Akvarium, Charlottenlund, Denmark

In the course of recent studies of the amphibia of East Africa, the first author has collected a form of *Hyperolius* in south-eastern Kenya which appears to be undescribed. A brief description is given here as the species is to be treated further in two coming papers by Schiøtz.

Hyperolius sheldricki sp. n.

Holotype No. A/366/3 An adult male from north of Aruba Dam, Tsavo National Park (East) 3° 18′ S, 38° 54′ E. April 1967.

Paratypes 6 ♂♂, A/366/2, 4-8 collected together with the holotype.

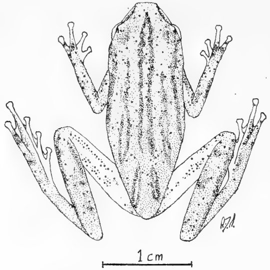
8 ♂♂, A/929/1-8 from 15 km west of Kakoneni 3° 14′ S, 39° 40′ E. April 1969.

The holotype and 6 paratypes are to be kept in The National Museum, Nairobi, 6 paratypes in the Zoological Museum, Copenhagen, and 2 paratypes in the British Museum (Nat. Hist.).

Diagnosis: A small member of the *Hyperolius viridiflavus* superspecies, the female phase* with a characteristic, apparently constant, pattern in dark and light brown as in Fig. 1; in life the inner aspects of the thigh and tibia dark maroon. The upper eyelid is slightly pointed in profile.

Description of the holotype: The snout is short; the gular sac and protective flap very large; webbing of the hind foot extensive; the upper eyelid bears a fairly conspicuous conical protuberance. The colour pattern is illustrated in Fig. 1, and consists of dark brown stripes on a very light brown background; dark brown spots are scattered fairly evenly over the back and upper parts of the arms and legs, with a concentration on the thighs and also on the gular flap. The belly is white, and the underside of hands, feet, femur, and tibia a dark maroon in life—pink in spirit. Some dimensions are given in Table 1.

*In most members of the genus *Hyperolius* all juveniles and some adult males have a cryptically coloured "juvenile phase", while all adult females and some of the males have what is often an entirely different "female phase". The juvenile phase is often identical or similar in different species, but the appearance of the female phase is often diagnostic.



Hyperolius sheldricki, holotype

Description of paratypes: All the paratypes are adult males. Those of series A/366 from near Aruba Dam are very uniform and similar to the holotype. Apart from A/929/1 which was kept in captivity for some time and is similar to the holotype, the series from west of Kakoneni differs somewhat as only three show, rather indistinctly, the diagnostic pattern; the remaining four having a more or less uniform, whitish, dorsum which is undoubtedly the juvenile phase. One of these, A/929/4, shows faint traces of lumbar spots, which seem to be the remains of an hourglass pattern. The combination of an hourglass pattern in the juvenile phase and a striped female phase would be unique in the *H. viridiflavus* superspecies.

Habitat: H. sheldricki appears to be confined to very temporary rain pools in a hot arid area with an erratic rainfall averaging 250 mm or less a year. This is in contrast to the neighbouring *H. viridiflavus ferniquei* (Mocquard) which seems to require breeding sites with permanent or nearly permanent water and a good reed cover.

The first population (A/366) was found a few days after the first heavy rain following a long dry period. They were in a shallow pan in which stood coarse dry grass and which was of a more temporary nature than the majority of other waterholes in the vicinity. The pan was practically unoccupied by other amphibia characteristic of the area. The frogs were very numerous and were calling while clinging to long grass stems protruding from the water. The second population (A/929) was calling in sparse grass bordering a shallow roadside ditch immediately after the first heavy storm of the rainy season. The water in the ditch had completely disappeared a few hours after the rain ceased. A number of nearby waterholes were investigated and, although densely populated with other amphibia, were not occupied by *H. sheldricki*.

Systematic remarks: By the shape of the head, the large gular pouch, and the voice, *H. sheldricki* is a typical member of the *H. viridiflavus* superspecies.

No.		*Loc.*	*Snout-vent*	*Tibia*	*width of prot. flap*	*Foot*
Holotype	A/366/3	near Aruba	24.1	12.4	6.9	10.7
Paratype	A/366/2	,, ,,	23.8	12.3	7.9	10.9
,,	/4	,, ,,	22.2	12.7	7.2	10.7
,,	/5	,, ,,	23.4	12.2	6.5	10.6
,,	/6	,, ,,	24.0	12.2	6.8	10.7
,,	/7	,, ,,	23.2	12.6	6.9	10.9
,,	/8	,, ,,	23.2	12.1	6.2	10.7
,,	A/929/1	W. of Kakoneni	22.2	10.5	6.1	9.4
,,	/2	,, ,,	18.2	9.5	4.6	8.6
,,	/3	,, ,,	21.4	10.6	6.7	8.4
,,	/4	,, ,,	21.7	10.6	6.0	9.7
,,	/5	,, ,,	19.2	9.5	5.0	8.3
,,	/6	,, ,,	21.3	10.4	5.7	8.9
,,	/7	,, ,,	21.3	10.0	6.0	8.9
,,	/8	,, ,,	20.7	9.5	6.5	8.6

Table 1 *Measurements of H. sheldricki* in millimetres

It is regarded as having full specific rank as it does not show any great relationship in pattern to the adjacent forms of that group: *H. v. ferniquei*, *H. v. glandicolor* (Peters), and *H. mariae* Barbour and Loveridge. *H. v. ferniquei* has, furthermore, been collected at Kenani less than 80 km from the type locality. The nature of the known breeding localities would suggest a strong ecological separation.

It is a pleasure for us to name this new species after David Sheldrick, warden of Tsavo National Park (East), in appreciation of his invaluable help and hospitality over many years on occasions when we, more often one of us (A.D.-M.), have been at Tsavo.

ACKNOWLEDGEMENTS

We are grateful to the Director and Trustees of the Kenya National Parks for permission to work in the Tsavo Park, to A. D. Forbes-Watson for his help in the field, and to the Museums Trustees of Kenya for permission to publish.

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(Received 10th August, 1971).

Published by The East Africa Natural History Society, Box 44486, Nairobi, Kenya and printed by Kenya Litho Ltd., Box 40775, Nairobi.

JOURNAL OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 28 25th JANUARY 1972 No. 129

AN ORNITHOLOGICAL SURVEY OF THE KIDEPO NATIONAL PARK, NORTHERN UGANDA

By

C. C. H. Elliott

Percy FitzPatrick Institute of African Ornithology, University of Cape Town

INTRODUCTION

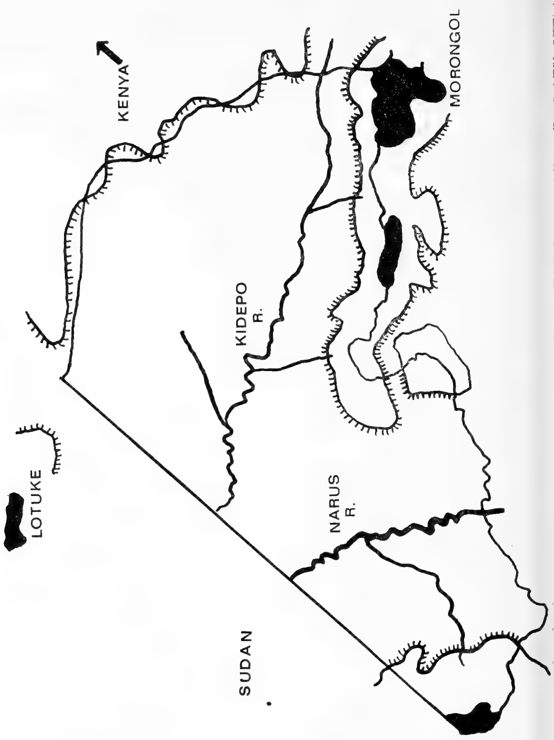
This paper summarises the results of the Oxford University expedition to the Kidepo Valley, in the long vacation of 1966 (July 20th–September 10th). The expedition was undertaken by the author and R. L. Rolfe (and, although this paper is the former's responsibility, the field work was a combined effort in which Rolfe did a lion's share).

The main aims of the expedition were to study the birds of this very unspoilt region and to satisfy the conditions laid down by Uganda National Parks, when permission was given to work in the Kidepo, by making a complete list of the species occurring in the park and preparing a small collection of skins sufficient for the identification purposes of future researchers and interested tourists. In the event, the previous provisional list of 200 species was increased to almost 400 and a collection of 240 skins of about 170 species was made. Most of the skins are now available at the Kidepo H.Q., while about 30 of the exceptional ones have been presented to the British Museum.

The main method used was to set strings of mist-nets in suitable trapping sites around each camping place. The surrounding country was then covered on foot by one man while the other operated the nets. Several species were never seen except when caught in the nets. Shooting was used to collect a few difficult species, such as the nightjars, for which nets were of no use.

The vegetation of the area was already well known from botanical surveys carried out principally by Thomas (1943) and Wilson (1962), the latter being the more detailed for the Kidepo. This, combined with the two weeks of assistance to our expedition by J. M. Lock, a botanist working for NUTAE at the Queen Elizabeth Park, provided a reasonable knowledge of at least the broader aspects of the vegetation. Thus, we were able to correlate the distribution of birds with the vegetation, as described in the first part of the paper. General observations and the collection of skins, the more difficult to identify being taken back to the U.K. for further study, produced some interesting records which are discussed below in the two sections—Distribution and Races, and Breeding and Moult.

A short survey was made on three species of *Tockus* (Hornbills) and results are given in the third section. The fourth (and last) includes incidental observations on the Park birds.



Map 1

KIDEPO PARK, UGANDA
—hatched line; ca.5000′ contour
—solid black; forest
—Scale 1″: 6 miles (1 cm:3.8 km.)

Throughout this paper, nomenclature follows C. M. N. White (1960–1965), while the English names are those of Praed & Grant.

General Description of the Park

The Kidepo Park occupies 500 sq. miles (1300 km²) in the north-east corner of Karamoja Province of Uganda (around 4°N). In the north, it borders the Sudan for 30 miles (50 km) and its eastern boundary is about 15 miles (25 km) from the Kenya border. It consists mainly of the basins of the rivers Narus and Kidepo which flow north-west to meet in the Sudan. Both flow only during the rains, being for most of the year dry, except for pools trapped behind rocky catchments. The Kidepo valley (average altitude 3200 ft (975 m) is surrounded on all sides (see Map 1), except for the north-north-west, by mountain ranges (composed of rocks of the Basement complex), mostly about 5000 ft (1500 m) high, but rising to 9020 ft (2749 m) at Mt. Morongole and slightly lower at Mt. Lotuke, in the Sudan. The floor of the valley is almost flat, but is broken up by the numerous tributaries of the river and the occasional *kopje* (inselbergs) protruding a few hundred feet above the plains. The Narus valley is less open and flattens out only as it nears the Sudan border. The Narus river itself is about a quarter the width of the Kidepo at its widest, but has areas of flood-plain on either side, which have a thick growth of "elephant-grass" and acacia. The uplands west of the Narus rise to the 7400 ft (2250 m) mountain, Lonyili.

The Kidepo National Park was created in 1962, when it had for some years been a game reserve, in which shooting was allowed but controlled. The whole area is just north of a belt cleared of bush in the anti-tsetse campaign, but tsetse is rife in the Park itself. As a National Park, the Kidepo is quite different from the other two parks in Uganda, having plains species, like cheetah and Bright's Gazelle. The birdlife is also very varied, as indicated by the number of species, which is larger than that of Murchison Falls National Park and almost as large as that of the Queen Elizabeth National Park, both of which have large migrant populations attracted to their permanent water supplies.

Climate

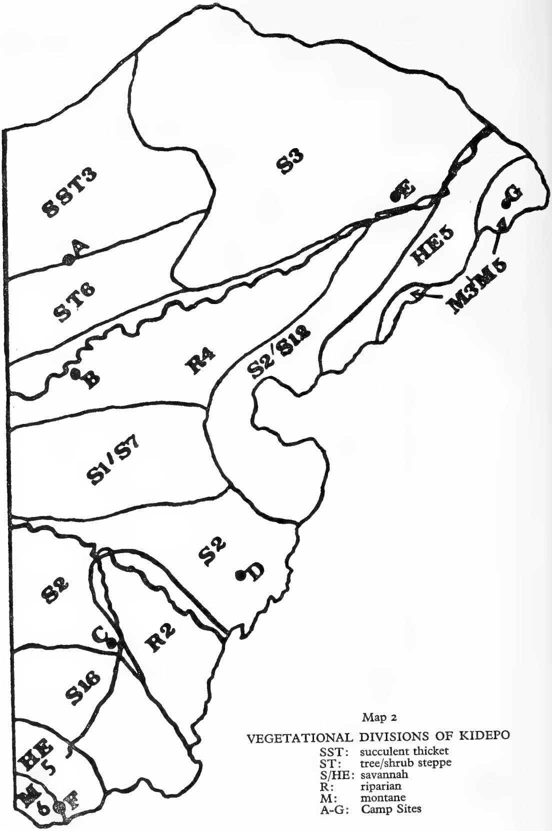
A rain-gauge has been operating only during the past few months in the Kidepo and then only at the Park headquarters. The records from Moroto station suggest that the average annual rainfall for most of the Park would be 30–35 ins (760–890 mm), precipitated in the months of May to October. An unbroken dry season of at least five months is usual and it may extend to eight months (e.g. 1965). The vegetation indicates that the driest area is in the extreme north-east corner of the Park, SST3 (see Map II), the rainfall being as low as 15–20 ins (380–510 mm) per annum (Wilson, Lock). This may be due to its being in the rainshadow of Mt. Lotuke. The two montane forest areas are the wettest in the park, with an estimated rainfall of at least 45 in (1150 mm) per annum. (Wilson). On Morongole, in particular, this rainfall is due in part to precipitation from dank mists which periodically sweep over its upper slopes. The maximum temperatures occur during the dry season, December and January.

Avifauna

In the following descriptions of the vegetation areas, only those species restricted to a given area are mentioned. Greater detail is given in the section on riparian "forest" and the distribution of all species is included in the appendix to this paper.

VEGETATION

From the forest of Lonyili and Morongole northwards, there is a decrease in rainfall and altitude accompanied by vegetation changes (Map II). The differences between the



Map 2

VEGETATIONAL DIVISIONS OF KIDEPO

SST:	succulent thicket
ST:	tree/shrub steppe
S/HE:	savannah
R:	riparian
M:	montane
A-G:	Camp Sites

two sets of contours can mostly be related to the initial differences in the heights of the two mountains and also to the much gentler decrease in altitude occurring in the more hilly Lonyili half than in the quite dramatic plunge to the flat plain of the Morongole half. The difficulty about such a broad physiognomic description, correct as it may be about the important aspects of the vegetation, is to relate the bird distribution to it. Each segment is broken up by atypical vegetation—whether, for example, it be riparian forest of varying thickness, or swamps fed by a sulphurous spring on the edge of the driest area of the Park.

It should be mentioned that this account is heavily based on Wilson (1962) for much of the vegetational description and his classification is used for vegetation divisions.

Savannah

I. Kananarok hotspring (A on map) SST3 (2): ST6

To the north of Camp A is found the Park's driest part, classified as SST3 (2) (Succulent Shrub Thicket) characterised by the occurrence of numerous succulent and woody shrubs, small trees and many succulent herbs, found in dense clumps 20–120 ft. (6–36 m.) in diameter, with intervals of bare ground.

SST3 (2) was the only part of the Kidepo where is to be found the Lesser Kudu and where the duiker is at all common. Very little other game occurred in this habitat, except for that attracted by the hotspring.

At the campsite, a three-acre (1.2 ha) area of swamp, caused by a sulphurous hotspring, lies about 10 miles (16 km) from the nearest permanent water, a recently-constructed dam.

To the south of Camp A, the vegetation becomes more open and is classified as ST6—Tree and Shrub Steppe. It is characterised by an open-to-fairly-dense assemblage of small trees and shrubs 6–12 ft (2–4 m) high, with an aerial coverage of 40–70 per cent. The thickets are much smaller than those of SST3, shrubs are fairly common but the ground layer is poorly developed, with a preponderance of herbs over grasses.

The area was rich in bird species, including *Amadina fasciata* and *Passer iagoensis*, which were not found in any other zone.

II. Kidepo River (B on map) R4; SI/S7

This is the largest area of *Borassus*—dominated riparian woodland in the Park, about three miles (4.8 km) at its widest. It is classified as R4.

The *Borassus* palms are often as high as 60 ft (18 m), with the result that a dense undergrowth of tall grasses, dominated by *Phragmites communis* Trin., can develop underneath. The shrubs *Lawsonia inermis* L. and *Pluchea dioscoridis* (L.) DC. are fairly common, right on the river banks and in the open areas of the community. Other than a herd of waterbuck and occasional visiting herds of elephants, no game was recorded within the *Borassus* woodland. Because these palms normally occur in Uganda in lines along river banks, it was suggested that a *Borassus* "forest" might have an unusual avifauna. This was not borne out by our observations, which showed that a few species were especially common in the area, but that none was restricted to it.

South of the area immediately affected by the Kidepo was a region of flat savannah shown as S1/S7, where the soil was heavy-clay type, rapidly softened by rain. The vegetation consisted of a mosaic of small trees 6 to 8 ft (1.8–2.4 m) high mixed with taller trees 15–20 ft (4.5–6 m). Shrubs are only occasional, these being *Cadaba farinosa* Forsk and *Harrisonia abyssinica* Oliv. Scattered *Balanites aegyptiaca* (L.) Del. are often associated with this community and a considerable variety of herbs is distributed among well-defined tufts of the dominant grass.

During our visit, the greatest concentration of game was found here. Lion, Bat-eared

Fox, and rhino were occasionally seen and plainsgame, such as zebra, hartebeeste, eland and Bright's Gazelle, were quite common.

III. Lorupei camp (C) and Apoka Hq. (D) S2 & S2/S12

The area S2 was the most thoroughly-explored in the Park, since it included the base to which we returned after each week's sortie. Where S2 touched the Park's eastern and western boundaries, especially in S2/S12, the ground became much more hilly, and the riparian thickets along the dried-up streams contributed more to the vegetation. On the lower parts, the vegetation consisted of tree savannah and savannah woodland, interspersed with much better-defined riparian forest. The savannah trees were mostly deciduous, averaging about 15–20 ft (4.5– 6 m) in height. The ground layer was dominated by perennial grasses such as *Setaria incrassata* (Hochst) Hack. Shrubs were rare. In the hilly areas, klipspringer, Rock Hyrax and, occasionally, Roan Antelope were seen. The savannah had a small population of hartebeeste, oribi and giraffe.

The thickly-distributed stands of trees and the well-developed ground layer contained many birds, some occupying the canopy (which often included multi-species bird parties) and others, chiefly ploceids, areas of grass. *Dendropicos obsoletus* (Wagler) found here, was the only species not found elsewhere.

IV. Narus River (Worked from D) R2

Unlike the previous vegetation type, the Narus River riparian woodland contained few species of birds, mostly ploceid seedeaters. The area was swampy in places and had two small man-made dams, which encouraged water birds. The woodlands contained trees up to 25 ft (7.5 m) tall, with a lush, perennial grass layer from 5 to 8 ft (1.5 to 2.5 m) in height and sometimes more, giving ground cover up to 90 per cent. The whole area was liable to flooding.

In the dry season, this area is said to be full of game, but apart from occasional herds of buffalo and elephant passing through, the only large animals seen by us were two crocodiles in one of the dams.

The only birds not found elsewhere were aquatic species.

V. Kopem Kopje (E on map). S3

This region was, next to SST3, perhaps the driest in the Park. The vegetation was classified as S3—a savannah woodland community of small trees, often regularly-spaced, with a dominantly perennial layer, mainly dominated by tufted grasses. Shrubs were rare, except where protection from fire existed such as in the crown of small rock outcrops.

Only a few days were spent at Kopem, from which most sorties were directed at the foothills of Morongole in order to get some idea of the altitude zonation of birds on that mountain.

Conclusion

The two most impressive things about the Kidepo were the total number of savannah birds and the variety within each habitat. Various experts made "off-the-cuff" estimates of about 200 as the total number of species to be expected from the region, on the grounds of its semi-aridity and its geographical position. The final total reached nearly 330 (excluding forest, montane and palearctic birds) which, for so small an area, compares dramatically with the total of 418 for all West Africa and of 497 for the whole of the Sudan (Moreau, 1966).

Of the 16 species unrecorded in the Sudan, 14 were savannah species and included such birds as *Apalis karamojae*, *Vidua hypocherina*, *Turdoides jardinei*, *Mirafra africanoides* and *Pterocles gutturalis*. By comparing the lists of typical species for each area, it is

apparent that, although certain species occur throughout the savannah, the basic population changes considerably over comparatively short distances. This can be related to similarly-rapid changes in vegetation, of course.

Forest and Upland

This section describes the vegetation in the Park above 5000 ft (1525 m), a region containing the two areas of montane forest and the surrounding upland vegetation, which has a bird population much influenced and overlapping with that of the forest. It then shows how the forest species extend their range down the tongues of riparian gallery forest, almost to the floor of the Kidepo valley.

VI. Lonyili Forest camp. (F on the map) M6 and HE5

In appearance, the relict forest of Lonyili, at 5000–6500 ft (1525–2000 m), was the only "real" forest in the whole Park. The community exists on deep soils and is perhaps best described by Macdonald & Cave's term: bowl-forest. Although the rainfall is probably similar to that of Morongole, it is much more effective in producing lush vegetation, because water collects in the depression, or bowl, on the side of the mountain. The forest is only about three miles (5 km) long and about a mile (1.5 km) wide.

The botany of the forest is not really known. Wilson did not investigate it, though he points out that, in composition, it was unlike any other in Karamoja and that its closest affinity was probably with the flora of the Imatong and Dongotona mountains of the Sudan.

The last important point is that the bulk of the forest was at 5500–6500 ft (1700–2000 m) and therefore can be considered lowland forest—quite distinct from the montane forest on Morongole, which commenced above approximately 7000 ft (2100 m).

The vegetation is classified by Wilson as M6—Tree Savannah; but, as stated, this refers mainly to the open areas and not to the forest patches. He gives three species of *Acacia* which reach a height of 60 ft (18 m) and are relict survivors of forest, so may occur within the forest patches.

Lock, the expedition's botanist, found the variety of trees in the forest of extreme interest and unlike the species in southern Uganda. He suggested that some of the larger trees may be a species of *Ficus*. They were over 100 ft (30 m) tall with broad buttressed trunks (often more than 20 ft (6 m) in diameter), some carrying fruit attractive to many species of birds.

A ferocious nettle, probably *Laportea alatipes* Hook f. grew in profusion in deep shade associated with the following:

Forest:	*Acacia abyssinica* Hochst.	*Ficus* spp.
	A. lahai Benth.	*Dracaena* spp.
	Albizia gummifera (Gmel.) C.A. Sm.	*Impatiens* sp.
	possibly a *Coffea*.	*Peperomia* sp.

Lock was unable to identify the tall 9–11 ft (2.7–3.3 m) plant of which the marsh in the centre of the forest was composed.

The forest had a population of about 25 Uganda blue monkeys and, during the dry season, it probably holds a small number of elephant and buffalo, of which there were many signs in the forest, such as well-worn paths. The tree savannah consisted of an open meadow extending from 6500 ft (1980 m) to the summit at 7400 ft (2255 m), in which the trees gradually became smaller and were more dominated by *Protea gaguedi* Gmel. Areas of bare rock also became more frequent and the summit consisted of large boulders, with a steep cliff falling away into the Sudan, and the bowl-forest, beginning on one of the gentler slopes on the Uganda side. The lower vegetation merged into HE5 type, where little time was spent on birds. The latter also applies to ST6.

Birds found only in M6 were: *Accipiter tachiro; Cisticola brachyptera* and *C. aberrans.* Those found only in the forest were: *Columba delegorguei; Merops lafresnayi; Lybius leucocephalus; Lybius bidentatus; Phyllastrephus fischeri; Alethe poliocephala; Apalis cinerea; Camaroptera chloronota; Nectarinia verticalis; Anthreptes collaris* and *Ploceus ocularis.*

Bearing in mind the forest's small size and low altitude, it is interesting to compare Lonyili with its nearest equivalent in the Sudan. This is the Lotti forest (about 50 miles (80 km) to the north, in the Imatong mountains), which is at a lower altitude, much larger and well-developed. The Lonyili forest would be expected to have a very impoverished version of the bird population of the Lotti forest and the brevity of the list shows this. Of the 15 species recorded in the Kidepo and unrecorded in the Sudan, only one, *Camaroptera chloronota*, is a forest bird. More than 65 species are listed for the southern Sudan (excluding the dry country species) many of which are forest species recorded in the southern ranges like Lotti. Notable absences from the Lonyili forest are six species of Warbler including two *Apalis;* seven species of thrush including three *Cossypha;* five Muscicapinae; seven Pycnonotidae; and all *Trichastoma.*

VII. Morongole Mountain: Camps at 6500 ft (1980 m). M3, M5 and HE5 and 10,200 ft (2500 m). (G on the map).

The vegetation of Morongole consists of: (a) "mist" forest and forest on steep slopes, equivalent to M3, both above 7000 ft (2135 m); (b) Highland tree savannah (i.e. scattered trees) M5 7000 ft (2135 m) to the summit, 9020 ft (2749 m) replaced below 7000 ft by savannah woodland, with HE5 (closer tree clumping).

Wilson describes HE5 as a savannah woodland of deciduous and compound-leaved trees, with a well-developed perennial grass layer. The tree heights average 10–20 ft (3–6 m). Unlike the forest birds of M3, the savannah species had a wide altitudinal range and many species occurring in HE5, were also found at 9000 ft (2750 m). Found only in HE5 was the species *Parisoma lugens.*

Although the general nature of the vegetation above HE5 is clear enough, with two forms of forest and an upland grassland, there seems to be a difference of opinion between Thomas (1943) and Wilson, on the actual composition and even on such important matters as to which were the dominant trees.

Thomas describes the meadow as "shrubby moorland", passing into "grassy moorland" (he does mention *Erica* spp. as occurring), while Wilson makes a point of saying that it is not moorland at all (no *Erica*), but should be described as "tree savannah" passing into "grass savannah". Only four of the 79 species listed by Wilson are given amongst the 15 quoted by Thomas.

Thomas also draws attention to the affinities of the vegetation with that of the Imatongs. *Coleus grandicalyx* E.A. Bruce, with violet-coloured flowers, from the high meadow and the grass, *Setaria splendida* Stapf, are found only on the two ranges.

Birds found only in M5 (in which are included the summit cliffs) were: *Gypaetus barbatus; Columba unicincta; Caprimulgus poliocephala* and *Psalidoprocne pristoptera.*

Thomas gives no details in his description of the forest vegetation, except to mention that *Dombeya goetzenii* K. Schum. is the dominant tree in the forest and that *Cussonia specata* Thunb. is common. Neither species is mentioned by Wilson, who classifies the area as "M3—Dry Montane Forest." He describes it as being "evergreen forest with an intermittent canopy, usually in large clumps, but occasionally contiguous with a marginal shrub layer. Depending on the density of the canopy, a herb/grass layer occurs quite frequently on the forest floor".

Wilson goes on: "The forest margin shrub layer varies greatly according to the successional state of transition to forest or fire climax grassland. Under the forest canopy the shrubs are not common except for *Senecio petitianus* A. Rich. which is a common liane. Ferns, lichens, mosses are common, particularly on the branches of the largest forest trees and Bracken *Pteridium aquilinum* Kuhn, is an occasional constituent".

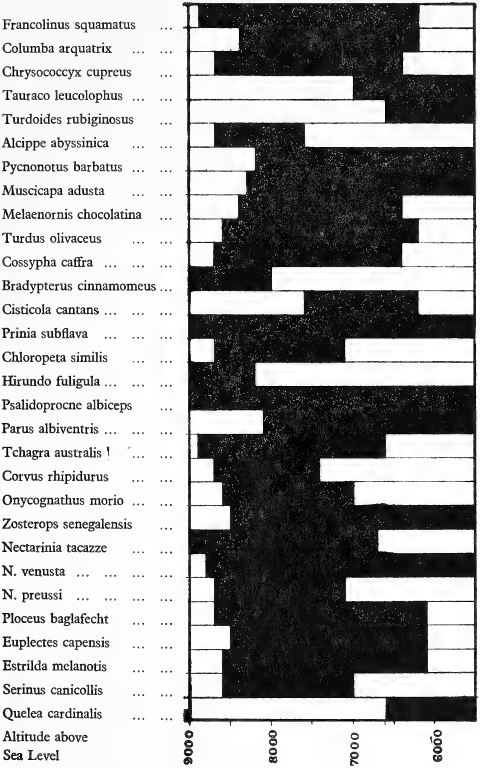


TABLE 1
ALTITUDINAL ZONATION OF BIRDS ON MORONGOLE MOUNTAIN

The M3 community develops best on the deep soils of plateau sites. On the steeper slopes, the composition changes considerably with *Juniperus procera* A. Rich., *Olea hochstetterii* Baker, and *Teclea nobilis* Del., becoming the dominant trees. A quite large population of the Karamoja race of mountain bushbuck living on the mountain, was found browsing in the meadows at dusk and dawn. A few klipspringer haunted the summit rocks. Leopard was the chief predator and one frequently roared from a rock a few hundred feet below our camp.

Birds found only in the montane forest were:

Accipiter melanoleucus; Columba arquatrix; Chrysococcyx cupreus; Musophaga rossae; Chloropeta similis; Phylloscopus umbrovirens and *Cryptospiza salvadori.*

The division of bird populations between the meadow and forest was not great, because many of the small passerines like *Phylloscopus umbrovirens* fed in the forest margins, while others like the sunbirds, although feeding mostly in the grassland, also fed in the forest canopy and presumably nested amongst the trailing *Usnea* spp. Others, like the Red-wing Starlings, were usually visible doing noisy aerobatics above the grassland, but descended to fruit trees in the forest to feed.

The Morongole forest birds were remarkable for their extreme paucity. Whereas the Lonyili forest appeared noisy and full of barbets, turacos and blue monkeys, the Morongole forest was almost silent, except for the flapping of sunbird wings high in the canopy and the reedy singing of *Chloropeta similis.* In the highest forest, there were no turacos, except for the isolated record of *Musophaga rossae.*

Perhaps the most conspicuous absentees from both forest areas were the Casqued Hornbills (*Bycanistes* spp.). The difference in numbers of forest species (36 spp. for Lonyili, and 25 for Morongole) is probably due to the different type of forest, attributable (at least partly) to altitude.

Macdonald & Cave point out that "bowl-forest" is the nearest approach to true rain forest, like those of the Congo, at this latitude; cloud-forest is much poorer and subject to cold dank mists, which are not generally conducive to the production of food-plants. It seems that the change from one type of forest to the other occurs at 7000 ft (2135 m) altitude. If we had had time to investigate the avifauna of some of the broad-gully gallery forest on Morongole at lower altitudes, we would probably have found a species composition much more like that of Lonyili. A similar paucity of birds was found by Tennent (1964) in the Kitui District mountains of Kenya which he explained not only by the poorness of a forest similar to Morongole, but also thought the effects of isolation important.

Isolation cannot be said to have played a part in reducing the number of species on Morongole. As indicated above, the forests of the southern Sudan (particularly the Imatongs) have a much richer forest avifauna although they are further from the presumed centre of dispersal of the forest species in the Kenya highlands.

Another point, which emerged from our observations, was the clear altitudinal zonation of certain birds on Morongole and Table I shows the altitude range of these 30 species.

Lastly, we come to the extensions of the forest species down to lower levels where these montane forest species (e.g., *Tauraco leucolophus*) met species typical of riparian forests (e.g., *Laniarius erythrogaster*) and those that feed in the surrounding savannah, seeking refuge back in the forest (e.g., *Turdoides jardinei*). I have tried to consider the riparian birds of four areas in the Park, i.e. the substantial gallery forest of the Lorupei (the branch of the Narus from Lonyili); the upper Kidepo; the narrower thicket/forest of the Kananarok rivers; and the minor branches of the Narus, the Kakel and Losigiria. The avifauna shows a gradation in the proportion of forest species as the distance from the forest increases.

The vegetation in these areas varies in size, is similar in appearance, but is of extremely varied constitution. Lock (pers. comm.) describes the Narus branches as being nearest Wilson's T2 and T3. But in places, particularly Lorupei, the vegetation is more developed than these (T2/T3) would indicate, with many large trees draped with lianas, including species of *Ficus* which attract the forest barbets and turacos.

In the following lists of birds, those also recorded in the two montane forests are marked *F*. Only 10 species were recorded in all or three out of four of the areas. Next, a list is given of the species occurring in two of the four areas, most of which are typical of riparian vegetation. Last is given a list of the species, individual to the riparian vegetation of each area, which begins to suggest that the bird population becomes impoverished the further it recedes from a forest source. Lorupei is the nearest (to Lonyili), Kidepo next (to Morongole), while Kananarok (to Lotuke) and Narus (to Morongole) are about the same distance from forest. The Kananarok species are, however, all thicket species.

Birds common to three or four areas:

Turtur tympanistria F
Tauraco leucolophus F
Tockus erythrorhynchus
Indicator indicator F
Campethera nubica
Glaucidium perlatum
Oriolus monacha
Pycnonotus barbatus
Terpsiphone viridis
Cichladusa guttata
Cossypha heuglini F
Camaroptera brachyura
Tchagra senegala
Laniarius barbatus
Turdoides rubiginosus

Birds common to two areas:

Streptopelia semitorquata F
Chrysococcyx caprius
Psittacula krameri
Poicephalus meyeri
Halcyon senegalensis
Corythaixoides leucogaster
Otus scops
Colius striatus
Lybius lacrymosus
Thripias namaquus
Batis molitor
Sylvietta whytii
Prionops plumata
Nectarinia mariquensis

Birds individual to each area:

Lorupei:

Francolinus squamatus F
Turtur abyssinicus
T. afer
Centropus superciliosus
Crinifer zonurus
Merops lafresnayii F
Indicator variegatus
Turdoides jardinei
Platysteira cyanea F
Turdus pelios
Hypargos nitidulus F
Coracina pectoralis
Laniarius ferrugineus F
Malaconotus sul £ ureopectus
Zosterops senegalensis F
Z. virens

Kidepo:

Treron waalia F
Halcyon chelicuti
Phoeniculus purpureus
Bubo lacteus
Lybius rolleti
Apalis pulchella
Eremomela icteropygialis
Dicrurus adsimilis
Emberiza forbesi (only high alt.)
Serinus dorsostriatus

Kananarok:

Numida meleagris
Tockus deckeni
Bradornis pallidus
Phoeniculus minor
Pogoniulus minor
Laniarius funebris
Nectarinia senegalensis
Estrilda erythronotos
Petronia xanthocollis
Pytelia melba
Ploceus luteolus

Narus:

Pytelia afra
Cuculus clamosus

Compare the avifauna of the four riparian types by Jaffard's Coefficient of Community (C.C.) or Simpson's Coefficient (S.C.), Hagmeier & Stults (1964). If two populations of equal size have a C.C. of 68.5, 75 per cent of the species is common to both; or if when the S.C. value is 75, more than 75 per cent of the smaller of the two is found in the larger, then in either case the populations are considered faunistically identical. Using these methods, the only two populations shown to be faunistically identical are those of the Lorupei and Narus. Since one is a branch of the other, this would be expected.

Below, (Table II), are the other S.C. values. They reinforce the point that the avifauna of the Kidepo does change substantially over a very small area (Kidepo $\xleftrightarrow{48}$ Kananarok, a distance of only about 10 miles).

TABLE II

	Lorupei	*Narus*	*Kidepo*	*Kananarok*
Lorupei	—	91	58	55
Narus	91	—	67	67
Kidepo	58	67	—	48
Kananarok	55	67	48	—

BREEDING AND MOULT.

The semi-arid climate of the Kidepo means that the whole Park, except for the small areas of the two mountain ranges above about 6500 ft (1980 m) is subject to great but irregular seasonal variation. In such circumstances, the ultimate factor controlling breeding seasons is the occurrence of the rains, with the insectivores mostly breeding at the start and the seed-eaters towards the end. Each thereby feeds its young during a food abundance.

The breeding season of a species can be determined from (i) observation of nests, eggs or recently-fledged young; (ii) the condition of the gonads; (iii) extrapolation from moult, which in most species at this latitude follows breeding.

The assumption is made that food is short during about eight months of most years and that this is not countered by the migration of relatively few birds. The deduction is less valid for species that live in deep forest or high mountains, where seasonal variation is less marked and the rigours of moult can be spread over a greater length of time.

However, only three species on which we have data fall into this category, namely *Cisticola cantans*, *Phylloscopus umbrovirens* and *Cossypha caffra*, for which we did not obtain support from either of the other lines of evidence (i.e., observation or gonads).

But in no case is the breeding of any species deduced from moult, contrary to what might have been expected from previous knowledge.

The 40 species breeding during the seven weeks of our visit are listed below, with the abbreviations: O=Observation; G=Gonads; M=Moult.

Aegypius tracheliotus	O.
Coturnix delegorguei	O.G.M.
Streptopelia capicola	G.
Streptopelia senegalensis	O.G.M.
Streptopelia decipiens	O.
Ceyx picta	M.
Lybius leucomelas	M.
Indicator indicator	O.M.
Indicator variegatus	M.
Campethera nubica	M.
Turdoides jardinei	G.
Turdoides rubiginosus	M.
Alcippe abyssinica	O.M.
Prinia subflava	M.
Cisticola chiniana	O.
C. cantans	M.
Sphenoeacus mentalis	G.
Prionops plumata	O.
Eurocephalus anguitimens	M.
Lanius excubitorius	M.
Anthreptes collaris	G.
Nectarinia venusta	G.
Bubalornis albirostris	O.G.
Ploceus cucullatus	O.G.M.
P. jacksoni	G.
P. baglafecht emini	O.G.M.

Platysteira cyanea	G.	*P. luteolus*	M.
Batis molitor	M.	*Euplectes gierowii*	G.
Terpsiphone viridis	M.	*E. hordeaceus*	G.
Cossypha caffra	M.	*E. albonotatus*	G.
Sylvietta whytii	O.G.	*Quelea quelea*	G.
Camaroptera brachyura	O.G.	*Q. cardinalis*	O.
Phylloscopus umbrovirens	M.	*Petronia xanthocollis*	M.

By far the most conspicuous and numerous of the 40 breeding species were the seedeaters, the large areas of long grass in the Narus valley being alive with breeding *Quelea*, *Euplectes* and some other ploceids. The area around Kananarok hotspring was also full of nests of *Coturnix delegorguei* and *Streptopelia senegalensis* in various stages of development.

On the one hand, only five of the 15 seed-eating species were found in moult, indicating that most were still breeding during August and September, whilst of the 22 insectivorous/carnivorous species, 17 were either moulting or (those marked O) recently-fledged chicks or juveniles were seen, suggesting breeding in June or July. Thus, the evidence supports the presumption that the insectivorous species breed before the seedeaters.

DISTRIBUTION AND RACES

The Kidepo is interesting geographically, because it is only about 50 miles (80 km) from the Imatong and Dongotona and about 10 miles (16 km) from the Didinga ranges in the southern Sudan. These three massifs, with Morongole, are only 200 miles (320 km) from the Ethiopian highlands, with the Boma hills as an intermediate stepping stone.

Nevertheless, although some of the races of our species were the Ethiopian ones, the montane birds, at least, are very much those of the Kenya highlands (Moreau, 1966), the rich avifauna of the Imatong-Lotti forest being a particularly good example.

The proximity of the Kidepo to the Sudan and Ethiopia, however, combined with the past distribution of ornithologists (especially the fact that the nearest thorough collecting expedition south of the Kidepo has been on Mt. Elgon), produced some interesting records. These are given below under the categories of species and races new to Uganda, undescribed races and extensions of known range. Where races are mentioned, these are based on skins.

1. Species new to Uganda

Merops orientalis, Little Green Bee-eater. Most probably, it is of the race *cleopatra* as this has been identified as far south as Torit in the Sudan. The Kidepo is probably the southernmost limit of the species. Typical habitat: Sl/S7. *Cercotrichas leucophrys leucoptera*, White-winged Scrub Robin. The record represents the western limit of the species in East Africa. The typical habitat: SST3 and S3.

2. Races new to Uganda

Caprimulgus poliocephalus poliocephalus, Abyssinian Nightjar. Extension from western Uganda (Jackson), or 50 miles (80 km) south from Imatongs (White).
Dendropicos fuscescens hemprichii, Cardinal Woodpecker. An extension of range from the east bank of Lake Rudolf (150 miles (240 km) west) between areas of *D.f. lepidus* (30 miles (48 km), north) in the Sudan and 100 miles (160 km) south in Moroto. Habitat: 6500 ft (1980 m) HE5. *Cisticola aberrans petrophila*, Rock-loving Cisticola. A small extension, 40 miles (64 km) south from the Dongotona Mts. brings this into Uganda. Habitat: 6500 ft. (1980 m). M6.
Cisticola chiniana bodessa, Rattling Cisticola. Cave & MacDonald, and White, record

C. c. simplex for the southern Sudan and Karamoja respectively. *C.c. bodessa* is the Ethiopian race, previously with its southern limit on the Boma hills. Habitat: R4.
Tchagra senegala habessinica, Black-headed Bush Shrike. An extension, 50 miles (80 km) south across the border from the Imatongs. Widespread below 5500 ft (1675 m).
Corvus rhipidurus, Fantail Raven. This is mentioned neither by Praed & Grant, nor by White for Uganda, despite having been collected near Morongole by Stoneham (1926). *Kopje* above 3000 ft (900 m).
Estrilda melanotis quartinia, Yellow-bellied Waxbill. An extension across the border from the Imatongs. 8300 ft (2525 m). Meadow M5.
Estrilda erythronotos charmosygna, Black-cheeked Waxbill. An extension of the Ethiopian race 250 miles (400 km) west. *E.e. delamerei* is found only in southern Uganda.

3. Extensions of Range within Uganda

These include interesting records of species which previously have been found only in the large areas of forest on the Congo border.
Larus fuscus fuscus, Lesser Black-backed Gull. Praed & Grant say that it visits larger inland lakes, but is rarely seen far from the coast. Lake Rudolf is the nearest large lake 190 miles (300 km) east and the nearest coast is 700 miles (1125 m) S.E. The condition of the bird was poor enough to elicit attack from a Nubian Vulture, *Aegypius tracheliotus*, and a Bateleur, *Terathopius ecaudatus*, before being rescued by us (to die two days later).
Musophaga rossae, Ross's Turaco. The consensus of opinion (Jackson, White, Cave) is that this Turaco occurs all over Uganda and not only south of the Lango swamp, 150 miles (240 km) south-east as indicated by Praed & Grant.
Eurystomus glaucurus suahelicus, Broad-billed Roller. The expected race for the Kidepo would be *E.g. aethiopicus*. Our specimen indicates an extension 250 miles (400 km) north from Elgon.
Camaroptera chloronota, Olive-green Camaroptera. Forest species; well outside its normal range of south-western Uganda forests.
Apalis karamojae, Karamoja Apalis. This record extends the peculiar distribution (the isolated areas of northern Uganda (near Moroto) and Nzega in Tanzania) 100 miles (160 km) northwards from the Mt. Moroto region. Little is known of its habits. Our single record was of a party of five birds, feeding low in dwarf *Acacias*, mostly *A. drepanolobium* and small *Combretum* stands.
Hypargos nitidulus schlegeli, Green-backed Twinspot. Previously recorded only from the forests and adjacent areas to the Congo forests. Macdonald & Cave found *H.n. chubbi* in the nearby Dongotonas. Typical habitat: gallery forest within S16, where very difficult to see; only recorded after capture in mist-nets.

4. Possible New Races

Three species, collected above 8000 ft (2440 m) on Morongole, are represented there by birds that appeared to differ subspecifically from other populations and might be worthy of formal description.
Bradypterus cinnamomeus, Cinnamon Bracken Warbler. Four collected. Closest to *B.c. cavei* from the Imatongs, but differ in being whiter on the chest and belly and dingey-brown on the upper surfaces instead of a rich chestnut. They are also, on average, a little smaller than the Imatong race.
Phylloscopus umbrovirens, Brown Woodland Warbler. Three collected. The Morongole birds appear to be intermediate between *mackenziana* and *omoensis* in that it is mainly whitish on the underside, like the former, and yet more greenish-brown above, like the latter.
Turdus abyssinicus, Olive Thrush. Two collected. Nearest to *T.a. abyssinicus*, particularly those from the Imatongs and those from Elgon, previously known as *elgonensis*. It is,

however, much greyer on the chest and paler tawny on the flanks than any of the typical *abyssinicus* birds in the British Museum, including specimens from Elgon.

FEEDING HABITS OF HORNBILLS

Of the four species of the genus *Tockus* which inhabit the park, only three, *T. nasutus*, Grey Hornbill; *T. erythrorhynchus*, Red-billed Hornbill; and *T. deckeni*, Jackson's Hornbill were more or less common. All are about the same size and shape (beak differences are not initially striking) and all have been recorded in the literature as occupying the same sort of habitat and as feeding on the same kinds of food, with no hint of ecological separation.

Our observations were directed to seeing if there was any habitat or food preference. The records necessarily apply only to the seven weeks of the expedition; but, since very little has yet been published on the subject, it seems worth while to give tentative conclusions based on some 300 records.

(a) *T. erythrorhynchus* (191 records) had a strong association with substantial riparian vegetation and was only occasionally found in dryer, open-plain areas of S3 and SST3. 55 per cent of the records were in area R4 (*Borassus* woodland).

(b) *T. nasutus* (52 records) was the widest-ranging of the three species, with 60 per cent of the records almost equally divided between areas A1/S7, S3 and S2. The birds were not permanently-based in any of these areas except S3, but tended to occupy one of them for about 10 days before vacating it for one of the other two. S3 savannah was the only area which exclusively contained *nasutus*.

(c) *T. deckeni* (28 records) was the least common of the three and was found typically in dense riparian thickets of smaller rivers and gullies. One pair always to be found in a single place, at the edge of R4.

Food: Nine *erythrorhynchus*, three *deckeni* and one *nasutus* stomachs analysed, showed, not surprisingly, that *erythrorhynchus* eat the greatest variety of food classified as follows:

T. erythrorhynchus: Yellow seeds, 1–3 mm. greatest diameter; Black seeds, 2–5 mm. g.d.; Orthoptera, grasshoppers; Isoptera, termites; Formicoidae, black ants; Lepidoptera, green/yellow caterpillars; *Quelea cardinalis* eggs; *Commelina* fruit (creeping monocot. herb); and Capparidaceae fruit (Shrub).

Common to all the stomachs were the yellow seeds; all but two stomachs contained black ants, and half contained termites. Opportunity had obviously been taken by the bird whose stomach contained 25 caterpillars. Egg-eating must be common; apart from the above record of *Q. cardinalis* eggs being eaten, *T. nasutus* was seen raiding a *Bubalornis albirostris/Plocepasser mahali* colony. Nesting ploceids were very hostile to both *T. erythrorhynchus* and *T. nasutus*.

T. deckeni: In general appearance, the stomach contents were very similar to those of *erythrorhynchus*, except for the absence of several items of animal food. One stomach contained only about 100 small snails:

Yellow seeds 1–7 mm. g.d.; Black ants; Coleoptera. Beetle *elytra;* Snails, 2–4 mm. g.d.; Small green fruit.

T. nasutus: The one stomach examined contained a base of yellow seeds, 1–3 mm., g.d., together with a higher proportion of pieces of stout beetle cuticle than was found in *deckeni*.

From the foregoing, it may be concluded that there is no sharp difference between the species in the habitats at the time of year encountered, although there was some preference by *erythrorhynchus* for R4, *deckeni* for ST6/S16 and *nasutus* for S3. But on at least four occasions, mixed flocks of *nasutus* and *erythrorhynchus* and, on one occasion, all three, were observed together. It is possible that the time of observation in the Kidepo was one of superabundant food being just after the end of the rains when there should be plenty, at least, of animal food.

That each species showed some preference for a particular habitat may indicate the

habitat in which the species more or less confines itself at other times of the year when food shortage occurs (Cain, pers. comm.). It is nevertheless very probable that the coexistence of the three species is accounted for by food differences. This, though unproven by available data, is suggested by differences in physical structure, particularly that of bill shape. While the bill of *erythrorhynchus* is slender and long, that of *nasutus* is about the same length, with a slightly greater depth, but has tooth-like ridges on the outer edges; that of *T. deckeni* is shorter and much deeper than either of the other two.

The *nasutus* ridges are probably adapted for holding and crushing and may possibly be specialised for heavily-armoured insects and hard-shelled fruit. The food of *erythrorhynchus* was shown to be very varied. Its long sharp bill suggests a more insectivorous or carnivorous diet than that of *deckeni* which, with its blunter shorter bill is possibly chiefly frugivorous.

Since the above was completed, A. Kemp (pers. comm.), working nearly 2000 miles (3200 km.) south in the Kruger National Park in South Africa, has informed me of his studies on the three hornbills *T. erythrorhynchus*, *T. flavirostris* and *T. nasutus*. His results so far make an interesting comparison with mine and he has kindly allowed me to quote them.

On habitat, his results are almost diametrically opposed to mine, as he finds that the typical habitat of *nasutus* is mainly riparian and secondarily tall-tree *Acacia nigrescens* woodland and that of *erythrorhynchus* is open—usually overgrazed—grassland. He correlates this with local behaviour, *nasutus* feeding in the trees, *erythrorhynchus* mostly on the ground, digging the earth and sifting piles of dung for insects.

He does, however, suggest that the foraging behaviour becomes generalised in the wet season and that *erythrorhynchus* in particular becomes a more active forager, often pursuing free-moving insects such as Orthoptera. This discrepancy between our ideas on habitat, at least for *erythrorhynchus*, may perhaps be due to the fact that observations in the Kidepo were made only in the wet season. It does seem odd, however, that on no occasion in seven weeks in the Kidepo did I see *nasutus* feeding in riparian vegetation, although *erythrorhynchus* was common there. Kemp mentions no change in the behaviour of *nasutus* in the wet season.

In the diet, we agree. He finds that *nasutus* is the main fruit-eater, especially on species with tough skins (*Diospyros* and *Pseudocadia*), and its main animal items are large hard *Coleoptera* and tree frogs. *T. erythrorhynchus* is confirmed as mostly carnivorous, 87 per cent of its food items being animal, but he includes a particular liking for *Coprina* beetles found in dung. Egg-eating has not been recorded, but opportunism occurs in all three species. For example, *nasutus* was recorded taking mice during a recent plague.

In both diet and habitat, Kemp found *flavirostris* less specialised than the other two species, as I found with *T. deckeni* in the Kidepo.

MISCELLANEOUS OBSERVATIONS

(a) On one occasion, the following mixed concourse of birds was observed feeding on a flying-ant swarm, Formicoidea:

Halcyon chelicuti
Merops bulocki
**Campethera nubica*
Apus caffer
Apus aequatorialis
Cypsiurus parvus
**Terpsiphone viridis*
Hirundo aethiopica
Hirundo senegalensis
Psalidoprocne albiceps
Coracina pectoralis
**Dicrurus adsimilis*
Corvinella corvina
**Oriolus monacha*
Cinnyricinclus leucogaster
Euplectes hordeaceus

Also present, but not actually observed feeding:
Quelea cardinalis; Streptopelia capicola

Of the 18 species recorded, only four (marked with *) are at all typical of mixed bird flocks of the area. These could be called "nucleus" species, while the others remain "circumference" species (Winterbottom, 1949), but it seems much more likely that they were just a chance collection of birds taking advantage of an obvious food supply.

(b) On another occasion, a Black Kite, *Milvus migrans*, was seen to fly into a tree where it was attacked with great commotion by three shrikes, *Eurocephalus anguitimens*. One clung to the kite's mantle with both claws and bill as the kite flew away 200 yds. (180 m.) before it released its grip. I imagine that this ferocious attack by the much smaller bird was more territorial than anti-predator, since there were no shrikes nesting in the area.

(c) On several occasions, Broad-billed Rollers, *Eurystomus glaucurus*, were seen hawking insects until nearly dark, in open woodland, and then collecting in a roost of 20 or 30 birds in one large tree. Roosting behaviour does not seem to have been recorded before.

ACKNOWLEDGEMENTS

The expedition was made possible by many people and my gratitude to them has been duly recorded in the *Oxford Exploration Club Bulletin*. In the preparation of this paper, my thanks are owed to the late R. E. Moreau; Professor A. J. Cain; Richard Rolfe; Mrs. M. K. Rowan; Professor J. M. Winterbottom; and A. D. Forbes-Watson, for helpful criticism of the manuscript.

I am also grateful to my father, Sir Hugh Elliott, for vetting the manuscript and for help in the subspecific identification of our skins which were lodged at the Natural History Museum. The paper's form was initially based on that by Elliott & Fuggles-Couchman (1948).

SUMMARY

The results of an ornithological survey of the Kidepo National Park, northern Uganda, carried out by an Oxford expedition in the long vacation of 1966, are recorded. The bird-plant communities of five principal types of lowland savannah, of two areas of upland forest and savannah, and of the riverine areas within the Park are described, details being given in the Appendix at the end. The 40 species breeding and the details of the form of the information are given. The more interesting records of species new to Uganda, undescribed races, races new to Uganda and extension of range within Uganda, are described. The problems of speciation of three closely similar species of the genus *Tockus* (Hornbills) are discussed. It is thought that the differences in the physical structure of the beaks of the birds allows different food and feeding habits which, in turn, allows considerable overlap and coexistence within the same general habitat. Incidental observations made by the expedition are recorded at the end.

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(Received 18th January, 1971).

APPENDIX I

Birds recorded in the Kidepo National Park, Uganda with an indication of their habitat preference

In the above descriptions of the vegetational areas of the Kidepo, only the bird species restricted to each area have been mentioned. Below is a summary of all records made from 20.7.66 to 10.9.66. This serves as a check-list of the Kidepo National Park but it should be remembered that only a small part of the annual cycle was covered and observations at other times of the year may give wider distributions for some birds. Some species were recorded in the very incomplete list of birds existing before our arrival, and were not seen by us. These have almost all been included and where the distribution was recorded, it has been marked in, where not, it has been left blank. The zone marked as SW refers to the hotspring swamp at Kananarok, which formed an oasis in the middle of the otherwise uniform regions SST3 and ST6.

Key to vegetation zones:

Savannah:	SST3 = dry shrub/thicket		Upland:	HE5 = savannah woodland	
	SW = swamp			M6 = tree savannah including Lonyili forest	
	ST6 = dry shrub/thicket				
	S1/S7 = open plain				
	S2/S12 = long grass/woodland			M5 = highland tree savannah	
	S3 = dry woodland			M3 = dry montane forest	
Riparian:	R4 = Kidepo R. area				
	R2 = Narus R. area				
	T2/T3 = Upper Narus branches				

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
Struthio camelus Linnaeus Ostrich	X		X	X	X	X							
Phalacrocorax africanus (Gmelin) Long-tailed Cormorant								X					
Anhinga rufa (Daudin) Darter								X					
Pelecanus onocrotalus Linnaeus White Pelican								X					
P. rufescens Gmelin Pink-backed Pelican								X					
Ardea cinerea Linnaeus Grey Heron								X					
A. melanocephala Vigors & Children Black-headed Heron					X			X					
Egretta alba (Linnaeus) Great White Egret								X					
E. intermedia (Wagler) Yellow-billed Egret								X					
E. garzetta (Linnaeus) Little Egret								X					
Ardeola ibis (Linnaeus) Buff-backed Heron								X					
A. ralloides (Scopoli) Squacco Heron								X					
Butorides striatus (Linnaeus) Green-backed Heron								X					
Scopus umbretta Gmelin Hamerkop								X					
Ciconia ciconia (Linnaeus) White Stork		X						X					
C. abdimii Lichtenstein Abdim's Stork								X					
C. episcopus (Boddaert) Bishop Stork								X					
Anastomus lamelligerus Temminck Openbill								X					
Leptoptilos crumeniferus (Lesson) Marabou	X		X	X	X	X	X						
Ibis ibis (Linnaeus) Wood Ibis								X					
Threskiornis aethiopica (Latham) Sacred Ibis								X					
Sarkidiornis melanotos (Pennant) Knob-billed Goose					X		X						
Dendrocygna viduata (Linnaeus) White-faced Tree-Duck								X					
D. bicolor (Vieillot) Fulvous Tree-Duck								X					
Sagittarius serpentarius (Miller) Secretary Bird			X	X	X	X							
Gyps ruppellii (Brehm) Rüppell's Griffon			X	X	X	X							
G. bengalensis (Gmelin) White-backed Vulture			X	X	X	X							
Trigonoceps occipitalis (Burchell) White-headed Vulture											X	X	
Aegypius tracheliotus (Forster) Lappet-faced Vulture				X	X								
Neophron monachus (Temminck) Hooded Vulture			X	X	X	X							

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
N. percnopterus (Linnaeus) Egyptian Vulture				X	X								
Falco peregrinus Tunstall Peregrine Falcon					X								
F. biarmicus Temminck Lanner					X								
F. chicquera Daudin Red-necked Falcon	X		X	X			X						
F. ardosiaceus Bonnaterre & Vieillot Grey Kestrel					X								
F. cuvieri Smith African Hobby				X	X								
F. tinnunculus Linnaeus Kestrel				X	X								
F. alopex Heuglin Fox Kestrel	X		X			X							
Polihierax semitorquatus Smith Pygmy Falcon									X				
Milvus migrans (Boddaert) Black Kite			X	X	X		X		X				
Elanus caeruleus (Desfontaines) Black-shouldered Kite			X	X	X	X					X		
Aquila verreauxii Lesson Verreauxs' Eagle											X	X	
A. rapax Temminck Tawny Eagle	X		X	X	X	X							
A. wahlbergi Sundevall Wahlberg's Eagle				X			X		X				
Hieraaetus spilogaster (Bonaparte) African Hawk-Eagle			X	X	X								
Polemaetus bellicosus (Daudin) Martial Eagle				X	X								
Lophaetus occipitalis (Daudin) Long-crested Hawk-Eagle			X	X	X		X			X			
Kaupifalco monogrammicus Temminck Lizzard Buzzard					X				X				
Circaetus cinereus Vieillot Brown Harrier-Eagle				X	X								
C. pectoralis Smith Black-chested Harrier-Eagle	X					X							
Butastur rufipennis (Sundevall) Grasshopper Buzzard			X	X									
Terathopius ecaudatus (Daudin) Bateleur	X		X	X	X	X					X		
Haliaeetus vocifer (Daudin) Fish Eagle							X	X					
Gypohierax angolensis (Gmelin) Palm-nut Vulture							X						
Gypaetus barbatus Linnaeus Lammergeyer												X	
Buteo oreophilus Hartert & Neumann Mountain Buzzard										X		X	
B. rufofuscus (Forster) Jackal Buzzard										X	X	X	
Buteo buteo (Linnaeus) Steppe Buzzard			X	X	X	X							
Accipiter tachiro (Daudin) African Goshawk										X	X		
A. melanoleucus Smith Great Sparrowhawk													X

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
A. badius (Gmelin) Shikra									X				
A. nisus Linnaeus Sparrowhawk					X			X	X				
A. minullus (Daudin) Little Sparrowhawk									X				
Melierax gabar (Daudin) Gabar Goshawk	X					X							
M. poliopterus Cabanis Pale Chanting Goshawk	X		X	X	X	X							
M. metabates Heuglin Dark Chanting Goshawk				X	X								
Circus macrourus (Gmelin) Pallid Harrier				X	X								
C. aeruginosus (Linnaeus) Marsh Harrier								X					
Polyboroides typus (Scopoli) Harrier-Hawk										X	X	X	
Francolinus squamatus Cassin Scaly Francolin									X	X	X	X	X
F. clappertoni Children Clapperton's Francolin			X	X	X								
F. sephaena (Smith) Crested Francolin	X		X	X	X	X							
F. leucoscepus Gray Yellow-necked Spurfowl	X		X			X							
F. icterorhynchus Heuglin Heuglin's Francolin			X	X	X								
F. afer (Müller) Grey-wing					X								
Coturnix delegorguei Delegorgue Harlequin Quail	X		X	X	X	X	X	X	X				
C. chinensis (J. & E. Verreaux) Blue Quail	X												
Ptilopachus petrosus (Gmelin) Stone Partridge										X			
Numida meleagris (Linnaeus) Tufted Guinea-fowl	X		X		X				X				
Gallinula chloropus (Linnaeus) Moorhen		X						X					
Crex egregia (Peters) African Crake								X					
Limnocorax flavirostra (Swainson) Black Crake		X						X					
Eupodotis senegalensis (Vieillot) White-bellied Bustard			X		X								
E. melanogaster (Rüppell) Black-bellied Bustard					X	X							
E. hartlaubii Heuglin Hartlaub's Bustard						X							
Otis kori Burchell Kori Bustard						X							
Neotis denhami (Children) Denham's Bustard			X	X									
Burhinus capensis (Lichtenstein) Spotted Thick-knee					X								
Actophilornis africanus (Gmelin) Jacana								X					
Vanellus senegallus (Linnaeus) Wattled Plover		X			X			X					

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
V. armatus (Burchell) Blacksmith Plover					X								
V. tectus (Boddaert) Blackhead Plover				X	X								
V. coronatus (Boddaert) Crowned Plover				X	X								
Charadrius pecuarius Temminck Kittlitz Sand-Plover					X			X					
C. tricollaris Vieillot Three-banded Plover					X			X					
C. hiaticula Linnaeus Ringed Plover								X					
Rostratula benghalensis (Linnaeus) Painted Snipe		X						X					
Calidris temminckii (Leisler) Temminck's Stint								X					
Tringa hypoleucos Linnaeus Common Sandpiper								X					
T. ochropus Linnaeus Green Sandpiper							X	X					
T. glareola Linnaeus Wood Sandpiper							X	X	X				
T. nebularia (Gunnerus) Greenshank							X						
Cursorius temminckii Swainson Temminck's Courser	X		X										
C. cinctus (*Heuglin*) Heuglin's Courser	X		X										
Larus fuscus Linnaeus Lesser Black-backed Gull							X						
Sterna nilotica Gmelin Gull-billed Tern							X						
Turnix sylvatica (Desfontaines) Button Quail	X		X							X			
Pterocles quadricinctus Temminck Four-banded Sandgrouse			X	X									
P. gutturalis Smith Yellow-throated Sandgrouse				X			X						
Columba arquatrix Temminck Olive Pigeon													X
C. guinea Linnaeus Speckled Pigeon							X				X		
C. unicincta Cassin Afep Pigeon												X	
C. delegorguei Delegorgue Bronze-naped Pigeon											X		
Treron waalia (Meyer) Bruce's Green Pigeon					X		X	X	X		X		
Oena capensis (Linnaeus) Namaqua Dove	X		X			X							
Streptopelia lugens (Rüppell) Pink-breasted Dove										X	X		
S. semitorquata (Rüppell) Red-eyed Dove	X		X	X			X		X		X		
S. decipiens (Hartlaub & Finsch) Mourning Dove		X	X										
S. senegalensis (Linnaeus) Laughing Dove	X	X	X	X	X	X	X						
S. vinacea (Gmelin) Vinaceous Dove	X		X	X	X								

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
S. capicola (Gmelin) Ring-necked Dove	X		X	X	X								
Turtur tympanistria (Temminck) Tambourine Dove							X		X				
T. chalcospilos (Wagler) Emerald-spotted Wood Dove				X	X								
T. afer (Linnaeus) Blue-spotted Wood Dove									X	X			
T. abyssinicus (Sharpe) Black-billed Blue-spotted Wood Dove									X				
Cuculus clamosus Latham Black Cuckoo									X				
C. canorus Linnaeus African Cuckoo	X												
C. solitarius Stephens Red-chested Cuckoo											X		
Clamator jacobinus (Boddaert) Black & White Cuckoo	X		X										
C. levaillantii Swainson Levaillant's Cuckoo							X						
Chrysococcyx cupreus (Shaw) Emerald Cuckoo													X
C. caprius (Boddaert) Didric Cuckoo									X		X		
C. klaas (Stephens) Klaas's Cuckoo					X				X		X		
Centropus toulou Müller Black Coucal								X					
C. superciliosus Hemprich & Ehrenberg White-browed Coucal			X	X	X		X						
C. senegalensis Linnaeus Senegal Coucal					X								
Crinifer zonurus (Rüppell) Eastern Grey Plantain-eater	X								X				
Corythaixoides leucogaster (Rüppell) White-bellied Go-away Bird	X				X	X							
Musophaga rossae (Gould) Ross's Turaco													X
Tauraco leucolophus (Heuglin) White-crested Turaco									X		X		X
Poicephalus meyeri Cretzschmar Brown Parrot			X		X				X				
Psittacula krameri (Scopoli) Rose-ringed Parrakeet							X		X				
Coracias naevia Daudin Rufous-crowned Roller	X			X	X								
C. abyssinica Hermann Abyssinian Roller	X		X		X	X							
Eurystomus glaucurus (Müller) Broad-billed Roller				X	X								
Ceryle rudis (Linnaeus) Pied Kingfisher								X					
Alcedo cristata Pallas Malachite Kingfisher								X					
Ceyx picta (Boddaert) Pygmy Kingfisher	X		X										
Halcyon chelicuti (Stanley) Striped Kingfisher	X				X				X				
H. senegalensis (Linnaeus) Woodland Kingfisher							X		X				

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
H. leucocephala (Müller) Grey-headed Kingfisher	X	X											
Merops pusillus Müller Little Bee-eater			X		X								
M. orientalis Latham Little Green Bee-eater				X			X						
M. bulocki Vieillot White-fronted Bee-eater					X						X		
M. lafresnayii Guerin Cinnamon-chested Bee-eater											X		
M. hirundineus Lichtenstein Swallow-tailed Bee-eater					X			X					
M. variegatus Vieillot Blue-breasted Bee-eater					X			X					
M. apiaster Linnaeus European Bee-eater					X					X			
Tockus nasutus (Linnaeus) Grey Hornbill	X		X	X	X	X		X					
T. erythrorhynchus (Temminck) Red-billed Hornbill	X		X	X	X		X	X	X				
T. deckeni (Grant) Jackson's Hornbill			X	X			X		X				
T. flavirostris (Rüppell) Yellow-billed Hornbill			X				X						
Bucorvus abyssinicus (Boddaert) Abyssinian Ground Hornbill			X	X	X	X							
Phoeniculus purpureus (Miller) Kakelaar					X	X	X		X				
P. minor (Rüppell) Abyssinian Scimitar-bill			X		X				X				
P. aterrimus (Stephens) Black Wood-Hoopoe								X	X				
Otus scops (Linnaeus) African Scops Owl					X		X		X				
O. leucotis (Temminck) White-faced Scops Owl				X	X								
Bubo lacteus (Temminck) Verreaux's Eagle Owl							X		X				
Glaucidium perlatum (Vieillot) Pearl-spotted Owlet									X				
Caprimulgus climacurus (Vieillot) Long-tailed Nightjar			X	X									
C. poliocephalus Rüppell Abyssinian Nightjar												X	
C. tristigma Rüppell Freckled Nightjar						X							
Macrodipteryx longipennis (Shaw) Standard-wing Nightjar			X		X								
M. vexillarius (Gould) Pennant-wing Nightjar				X	X								
Colius striatus Gmelin Speckled Mousebird				X	X		X		X	X	X		
C. macrourus (Linnaeus) Blue-naped Mousebird	X				X	X							
Lybius lacrymosus (Cabanis) Spotted-flanked Barbet	X				X	X			X				
L. leucomelas (Boddaert) Red-fronted Barbet			X										
L. leucocephalus (Defilippi) White-headed Barbet											X		

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
L. rolleti (Defilippi) Black-breasted Barbet									X				
L. bidentatus (Shaw) Double-toothed Barbet											X		
L. guifsobalito Herman Black-bellied Barbet													
Trachyphonus erythrocephalus Cabanis Red & Yellow Barbet	X		X										
T. darnaudii (Prevost & Des Murs) D'Arnaud's Barbet	X		X	X			X						
Pogoniulus pusillus (Dumont) Red-fronted Tinkerbird			X						X				
Indicator indicator (Sparrman) Greater Honeyguide				X	X		X	X	X		X		X
I. minor Stephens Lesser Honeyguide											X		X
I. variegatus Lesson Scaly-throated Honeyguide									X	X	X		X
Campethera nubica (Boddaert) Nubian Woodpecker					X				X				
Mesopicos goertae (Müller) Grey Woodpecker				X	X		X			X	X		
Dendropicos obsoletus (Wagler) Brown-backed Woodpecker					X								
D. fuscescens (Vieillot) Cardinal Woodpecker										X			
Thripias namaquus Lichtenstein Bearded Woodpecker					X				X	X			
Cypsiurus parvus (Lichtenstein) Palm Swift		X		X	X		X						
Apus caffer (Lichtenstein) White-rumped Swift				X	X								
A. aequatorialis (von Müller) Mottled Swift					X							X	
A. affinis (Gray) Little Swift												X	X
A. niansae (Reichenow) Nyanza Swift											X	X	
A. melba (Linnaeus) Alpine Swift				X	X								
A. apus (Linnaeus) Common Swift				X	X								
Mirafra africana Smith Rufous-naped Lark	X		X										
M. africanoides Smith Fawn-coloured Lark	X		X										
M. javanica Horsfield Singing Bush-Lark				X	X								
M. rufocinnamomea (Salvadori) Flappet Lark				X	X								
Anthus similis Jerdon Long-billed Pipit				X	X								
A. leucophrys Vieillot Plain-backed Pipit				X	X								
Motacilla alba Linnaeus African Pied Wagtail				X	X		X	X					
M. flava Linnaeus, Blue-headed Wagtail								X					
Tmetothylacus tenellus (Cabanis) Golden Pipit								X					

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
Macronyx croceus (Vieillot) Yellow-throated Longclaw			X	X	X								
Turdoides jardinei (Smith) Arrow-marked Babbler					X		X		X				
T. plebejus (Cretzschmar) Brown Babbler									X				
T. rubiginosus (Rüppell) Rufous Chatterer					X		X	X	X	X			
Alcippe abyssinica (Rüppell) Abyssinian Hill-babbler											X		X
Pycnonotus barbatus (Desfontaines) Dark-capped Bulbul					X		X		X		X		
Phyllastrephus fischeri (Reichenow) Fischer's Greenbul											X		
Platysteira cyanea (Müller) Wattle-eye									X		X		
Bradornis pallidus (Müller) Pale Flycatcher	X		X	X		X							
B. microrhynchus Reichenow Grey Flycatcher			X		X								
Empidornis semipartitus (Rüppell) Silver Bird				X	X		X						
Meleanornis edolioides (Swainson) Black Flycatcher				X	X								
M. chocolatina (Rüppell) White-eyed Slaty Flycatcher									X	X	X	X	X
Batis molitor (Hahn & Küster) Chin-spot Puff-back Flycatcher					X				X	X	X		
Muscipapa adusta (Boie) Dusky Flycatcher										X		X	X
Terpsiphone viridis (Müller) Paradise Flycatcher			X		X				X	X	X		X
Turdus abyssinicus Gmelin Olive Thrush											X		X
T. pelios (Bonaparte) African Thrush									X				
Oenanthe oenanthe (Linnaeus) Wheatear					X	X							
O. isabellina (Temminck) Isabelline Wheatear						X							
Cossypha caffra (Linnaeus) Robin-Chat											X		X
C. heuglini (Hartlaub) White-browed Robin-Chat									X		X		
Cercomela familiaris (Stephens) Familiar Chat					X	X							
Myrmecocichla albifrons (Rüppell) White-fronted Black Chat										X			
M. cinnamomeiventris (Lafresnaye) Cliff Chat										X	X		
Saxicola rubetra, (Linnaeus) Whinchat						X							
S. torquata (Linnaeus) Stonechat					X	X	X						
Alethe poliocephala (Bonaparte) Brown-chested Aethe											X		
Cichladusa guttata (Heuglin) Spotted Morning Warbler							X		X				
Cercotrichas leucophrys (Rüppell) White-winged Scrub Robin	X					X							

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
Apalis cinerea (Sharpe) Grey Apalis											X		
A. karamojae (van Someren) Karamoja Apalis						X							
A. pulchella Creztschmar Buff-bellied Warbler							X		X				
Parisoma lugens (Rüppell) Brown Tit-Flycatcher										X			
Phylloscopus umbrovirens (Rüppell) Brown Woodland Warbler													X
Prinia subflava (Gmelin) Tawny-flanked Prinia			X	X	X	X	X	X		X	X	X	
Camaroptera chloronota Reichenow Olive-green Camaroptera											X		
C. brachyura (Vieillot) Grey-backed Camaroptera			X	X	X			X	X	X			
Sylvietta brachyura Lafresnaye Crombec			X				X						
S. whytii Shelley Red-faced Crombec									X	X	X		
Eremomela icteropygialis (Lafresnaye) Yellow-bellied Eromomela	X								X	X			
E. pusilla Hartlaub Green-backed Eromomela													
Bradypterus cinnamomeus (Rüppell) Cinnamon Bracken Warbler													X
Cisticola juncidis (Rafinesque) Zitting Cisticola			X										
C. ruficeps (Cretzschmar) Red-pate Cisticola			X										
C. chiniana (Smith) Rattling Cisticola					X		X				X		
C. troglodytes (Antinori) Foxy Cisticola					X		X						
C. erythrops (Hartlaub) Red-faced Cisticola											X		
C. brachyptera (Sharpe) Siffling Cisticola											X		
C. aberrans (Smith) Rock-loving Cisticola											X		
C. cantans (Heuglin) Singing Cisticola										X		X	
C. ayresii (Hartlaub) Wing-snapping Cisticola													
C. nana Fischer & Reichenow Tiny Cisticola													
Sphenoeacus mentalis (Fraser) Moustache Warbler					X						X		
Chloropeta similis Richmond Mountain Yellow Flycatcher Warbler													X
Hirundo fuligula Lichtenstein African Rock Martin											X	X	
H. abyssinica Guérin Striped Swallow					X						X		
H. daurica Linnaeus Red-rumped Swallow											X	X	
H. senegalensis Linnaeus Mosque Swallow					X						X		
H. aethiopica Blanford Ethiopian Swallow					X							X	

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
H. semirufa Sundevall Rufous-chested Swallow				X	X								
H. smithii Leach Wire-tailed Swallow				X	X								
H. rustica Linnaeus European Swallow				X	X		X	X					
Riparia riparia (Linnaeus) Sand Martin							X	X					
R. paludicola (Vieillot) African Sand Martin							X	X					
Psalidoprocne albiceps Sclater White-headed Roughwing										X	X	X	
P. pristoptera (Rüppell) Black Roughwing												X	
Campephaga phoenicea (Latham) Black-Cuckoo-Shrike										X	X		
Coracina caesia (Lichtenstein) Grey Cuckoo-Shrike											X		X
C. pectoralis (Jardine & Selby) White-breasted Cuckoo-Shrike									X				
Dicrurus adsimilis (Bechstein) Drongo	X		X	X	X			X	X				
Prionops plumata (Shaw) Curly-crested Helmet Shrike	X		X						X	X			
Laniarius barbarus (Linnaeus) Black-headed Gonolek							X		X				
L. ferrugineus Gmelin Tropical Boubou									X		X		
L. funebris (Hartlaub) Slate-coloured Boubou									X				
Eurocephalus anguitimens Smith White-crowned Shrike				X	X								
Nilaus afer (Latham) Northern Brubru					X					X			
Lanius collaris Linnaeus Fiscal										X	X		
L. excubitorius Prevost & Des Murs Grey-backed Fiscal				X	X								
Corvinella corvina (Shaw) Yellow-billed Shrike	X			X	X				X				
Tchagra australis (Smith) Brown-headed Tchagra										X	X	X	X
T. senegala (Linnaeus) Black-headed Tchagra	X		X	X	X	X			X				
Dryoscopus gambensis (Lichtenstein) Puff-back Shrike											X		
Malaconotus blanchoti Stephens Grey-headed Bush Shrike									X				
M. sulfureopectus (Lesson) Sulphur-breasted Bush-Shrike									X				
Parus albiventris Shelley White-breasted Tit					X			X		X	X		
Parus funereus (Verreaux) Dusky Tit													
P. leucomelas Rüppell Black Tit													
Oriolus monacha (Gmelin) Black-headed Oriole		X		X	X		X		X			X	
O. auratus Vieillot African Golden Oriole													

SPECIES	SAVANNAH						RIPARIAN			UPLAND			
	SST3	SW	ST6	S1/S7	S2/S12	S3	R4	R2	T2/T3	HE5	M6	M5	M3
Corvus rhipidurus Hartert Fan-tailed Raven										X	X	X	
Ptilostomus afer (Linnaeus) Piapiac				X	X								
Onycognathus morio Linnaeus Redwing Starling												X	X
Lamprotornis chalcurus (Nordmann) Bronze-tailed Starling			X		X								
L. chloropterus Swainson Lesser Blue-eared Glossy Starling					X		X						
L. caudatus (Müller) Rüppell's Long-tailed Glossy Starling			X	X	X								
L. chalybaeus Hemprich & Ehrenberg Blue-eared Glossy Starling													
Cinnyricinclus sharpii (Jackson) Sharpe's Starling												X	
C. leucogaster (Gmelin) Violet-backed Starling			X		X								
Spreo superbus (Rüppell) Superb Starling				X		X							
Creatophora cinerea (Menschen) Wattled Starling	X					X							
Buphagus africanus (Linnaeus) Yellow-billed Oxpecker					X	X							
B. erythrorhynchus (Stanley) Red-billed Oxpecker				X	X	X							
Zosterops virens Sundevall Green White-eye									X				
Z. senegalensis Bonaparte Yellow White-eye									X	X	X		X
Nectarinia tacazze (Stanley) Tacazze Sunbird											X	X	
N. mariquensis (Smith) Mariqua Sunbird							X		X				
N. olivacea (Smith) Olive Sunbird	X												
N. pulchella (Linnaeus) Beautiful Sunbird			X	X			X						
N. venusta (Shaw & Nodder) Variable Sunbird			X		X					X	X	X	
N. famosa (Linnaeus) Malachite Sunbird										X	X		
N. senegalensis (Linnaeus) Scarlet-chested Sunbird									X	X	X		
N. amethystina (Shaw) Amethyst Sunbird										X	X		
N. verticalis (Latham) Green-headed Sunbird											X		
N. preussi (Reichenow) Northern Double-collared Sunbird												X	
Anthreptes collaris (Vieillot) Collared Sunbird											X		
A. longuemarei (Lesson) Violet-backed Sunbird	X		X										
Dinemellia dinemelli (Rüppell) White-headed Buffalo Weaver			X	X	X	X							
Bubalornis albirostris (Vieillot) Buffalo Weaver	X		X	X	X	X							
Plocepasser mahali Smith White-browed Sparrow Weaver	X	X		X	X		X						

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
P. superciliosus (Cretzschmar) Chestnut-crowned Sparrow-weaver	X					X							
Pseudonigrita arnaudi (Bonaparte) Grey-headed Social Weaver						X							
Passer eminibey (Hartlaub) Chestnut Sparrow	X		X										
P. iagoensis (Gould) Rufous Sparrow			X										
P. griseus (Vieillot) Grey Sparrow				X	X								
Sporopipes frontalis (Daudin) Speckled-fronted Weaver	X			X	X		X						
Petronia xanthocollis (Burton) Yellow-spotted Petronia					X				X				
Ploceus velatus Vieillot Masked Weaver	X		X				X						
P. rubiginosus Rüppell Chestnut Weaver	X	X											
P. cucullatus (Müller) Black-headed Weaver		X	X					X					
P. jacksoni Shelley Golden-backed Weaver							X	X					
P. baglafecht (Daudin) Emin's Weaver											X		X
P. ocularis Smith Spectacled Weaver											X		
P. luteolus (Lichtenstein) Little Weaver			X				X		X				
P. intermedius Rüppell Masked Weaver													
Malimbus rubriceps (Sundevall) Red-headed Weaver										X			
Quelea quelea (Linnaeus) Red-billed Quelea								X		X			
Q. cardinalis (Hartlaub) Cardinal Quelea		X	X	X	X		X	X		X			
Amadina fasciata (Gmelin) Cut-throat			X										
Euplectes orix (Linnaeus) Red-Bishop					X		X	X					
E. albonotatus (Cassin) White-winged Widow Bird	X			X	X			X					
E. capensis (Linnaeus) Yellow Bishop										X	X	X	
E. hordeaceus (Linnaeus) Black-winged Red Bishop					X			X					
E. gierowii Cabanis Black Bishop								X					
Lonchura cucullata (Swainson) Bronze Mannikin								X					
Cryptospiza salvadori Riechenow Abyssinian Crimson-Wing													X
Pytelia melba (Linnaeus) Green-winged Pytelia									X				
P. afra (Gmelin) Orange-winged Pytelia									X				
P. phoenicoptera Swainson Red-winged Pytelia									X				
Hypargos nitidulus (Hartlaub) Green-backed Twinspot									X				

SPECIES	*SAVANNAH*						*RIPARIAN*			*UPLAND*			
	SST3	*SW*	*ST6*	*S1/S7*	*S2/S12*	*S3*	*R4*	*R2*	*T2/T3*	*HE5*	*M6*	*M5*	*M3*
Lagonosticta rubricata (Lichtenstein) African Fire Finch										X	X		X
L. senegala (Linnaeus) Red-billed Fire Finch													
Estrilda astrild (Linnaeus) Waxbill				X	X								
E. bengala (Linnaeus) Red-cheeked Cordon-bleu	X			X	X		X						
E. erythronotos (Vieillot) Black-cheeked Waxbill	X		X			X	X		X				
E. melanotis (Temminck) Yellow-bellied Waxbill										X	X	X	
E. rhodopyga Sundevall Crimson-rumped Waxbill					X					X	X		
E. troglodytes (Lichtenstein) Black-rumped Waxbill										X			
E. paludicola (Heuglin) Fawn-breasted Waxbill										X	X		
Lagonosticta rara (Antinori) Black-bellied Waxbill													
Vidua macroura (Pallas) Pin-tailed Whydah					X		X						
V. hypocherina Verreaux Steel-blue Whydah	X		X										
V. paradisea (Linnaeus) Paradise Whydah	X			X									
Serinus dorsostriatus (Reichenow) White-bellied Canary	X		X				X						
S. atrogularis (Smith) Yellow-rumped Seed-eater				X	X								
S. canicollis (Swainson) Yellow-crowned Canary										X	X	X	
S. sulphuratus (Linnaeus) Brimstone Canary										X			
S. mozambicus (Müller) Yellow-fronted Canary													
Emberiza flaviventris Stephens Golden-breasted Bunting										X			
E. forbesi (Hartlaub) Brown-rumped Bunting									X				
E. tahapisi Smith Cinnamon-breasted Rock Bunting									X	X			

Published by The East Africa Natural History Society, Box 44486, Nairobi, Kenya and printed by Kenya Litho Ltd., Box 40775, Nairobi.

JOURNAL
OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

VOL. 28 **15th MARCH 1972** **No. 130**

ANNOTATED CHECK-LIST OF PLANTS OCCURRING IN LAKE MANYARA NATIONAL PARK

By

P. J. Greenway and D. F. Vesey-FitzGerald

INTRODUCTION

This check-list has been compiled to serve several interests. In the first place systematic botanists need to make name changes from time to time, so ecologists working in the park will find it useful to have a list of currently accepted names. Each determination is supported by a voucher number referring to a specimen retained in the Lake Manyara National Park herbarium, and in most cases duplicated at the Royal Botanic Gardens, Kew and in the East African Herbarium in Nairobi.

Lake Manyara lies in the botanical region designated T2 Northern Province of Tanzania, see map in the preface to the Flora of Tropical East Africa (1952). The species listed and the vegetation described are typical of a wide area in this region. The list should therefore be useful to botanists visiting this part of Tanzania.

Each species is annotated so as to give in the briefest possible form as much useful ecological information about the plant as possible.

The place where each plant usually occurs is indicated by a capital letter at the begining of each citation:—

P = The plateau above the rift wall 1200 m (4000 ft) altitude.
E = The escarpment thicket woodland, 1000–1200 m (3200–4000 ft) altitude.
W = The *Acacia* woodland, including acacia parkland, in the valley below the rift wall, 960 m (3150 ft) altitude.
F = The groundwater or riverine forest which is irrigated by flowing water.
S = The swamp (freshwater) and other temporary wet sites and rainwater pools.
A = The alkaline lake bed soils, 945 m (3100 foot) altitude; much of this area is periodically flooded by the lake.

The growth form, of each plant, whether tree, shrub or herb (non-woody plant) is stated, with qualifications where applicable, namely ann. = annual, per = perennial. Abundance is indicated by the following abbreviations (va) = very abundant, (a) = abundant, (f) = frequent, (o) = occasional, (r) = rare.

Brief habitat details and the status of each species in the course of succession are also indicated. It is however sometimes difficult to decide the precise status of plants occupying secondary sites. Plants that are characteristic of zones of transition between two formations are recorded as occurring in ecotones. Those regularly occurring during certain stages of succession are classed as seral plants. Other plants commonly occurring at disturbed sites are recorded as ruderal. Plants that are generally common in their

proper environment but not usually found away from it are recorded as casuals in the latter case. Such often occur on silt banks in river courses, at road sides, in borrow-pits or as weeds of cultivation. Some of these may be pioneers which will later spread in the habitat as invaders. Several alien species from other countries occur in the park.

The arrangement and numbering of the families is according to the first edition of Hutchinson, J. 'Families of Flowering Plants', Dicotyledons (1926) and Monocotyledons (1944). The genera and species for ease of reference are arranged in alphabetical order.

F. T. E. A. with year and date indicates that the Family has been published in the Flora of Tropical East Africa, Crown Agents for Overseas Governments, London.

COLLECTORS

The following collectors have contributed to the park herbarium and their gatherings are initialed:—P.J. Greenway (G. numbers), Mrs. Dingle, formerly at the Lake Manyara Hotel (D. numbers), Mrs. Richards, a visiting botanist (MR. numbers) and D. Vesey-FitzGerald (VFG. numbers).

THE RAINFALL

The mean annual rainfall during the 10-year period 1961–70 at the Park headquarters situated below the Rift Wall, Long: 35° 51′ E. Lat: 03° 21′ S., 975 m. (3200 ft.) altitude, was 38 inches (970 mm.).

There are two peak periods, March to April (long rains) and November to December (short rains). June to October is a dry period.

The rainfall is variable, the lowest recorded during the decade was 11 inches (280 mm.) during 1969, and the highest 47 inches (1200 mm.) during 1968. The south end of the park is generally wetter. For example during 1968 the record at Msasa camp (Lat: 03° 26′ S.) was 49 ins. (1240 mm.); at Ndala camp (Lat: 03° 28′ S.) 47 ins. (1200 mm.) and at Endabash river delta (Lat: 03° 34′ S.) 63 ins. (1600 mm.).

The level of the lake varies as a result of the rainfall over the catchment area. During 1960 the lake-bed flats were covered with sparse alkaline grassland and no water was visible from shore level. By 1970 the flats were completely inundated to a depth of over 3 m and the water had encroached into the tree line approximately along the 960 m (3150 ft.) contour.

THE VEGETATION

The vegetation of L. Manyara National Park has been described by Greenway and Vesey-FitzGerald (1969), and the role of the vegetation as a habitat for indigenous animals (pasture and browse) by Vesey-FitzGerald (1969).

The plant formations and associations are divided into three sequences (catenas) related to the drainage, namely:—

(i) the vegetation related to the land drainage from the plateau above the rift wall.

(ii) the vegetation that is irrigated by springs emerging from the base of the rift wall.

(iii) the zones of vegetation around the shallow alkaline lake.

In addition there is a number of plants occurring only at special sites that are not related to the catenary arrangement.

(1) *The land drainage catena.* The plateau above the north end of the park at 1200 m. alt. comprises a lava cap dissected by a steep-sided valleys. Above the northern end of the park the country is level and strewn with lava boulders and the soil is a badly drained dark red clay loam. The existing vegetation here is much disturbed. It comprises fire-induced grassland and wooded grassland. Between the Msasa and Endabash rivers the upland country is more broken and there are exposures of granitic rocks on

the ridges. Deeply dissected rocky gorges and waterfalls are a feature of the drainage from the plateau to the lake. The vegetation here is mainly secondarily derived wooded grassland. Relict vegetation survives in the gorges.

Above the south end of the park, in the catchment of the Endabash river, the escarpment is higher 1500 m. alt. and the plateau is hilly. Outcrops of granitic rock occur and the soil is a well-drained red sandy loam. The vegetation of the Marang forest reserve is a dry evergreen forest, but outside the reserve where the ground is not so high it is secondary fire-induced wooded grassland. None of the highland forest and only a fringe of the plateau lie within the park.

The escarpment face and the slopes of the valleys are steep and rocky. The vegetation here is a deciduous woodland and dry thicket, both of which have been modified by fire or replaced by secondary derived wooded grassland on the less steep slopes. In the valleys and along the streams there is fringing forest which in most parts has been modified by cutting and burning. Below the rift wall the slope is less steep and composed of rubble detritus. The valley floor is covered with redistributed soils supporting groundwater (*Acacia*) woodland with a grassy ground cover. This woodland has been modified by both fire and elephants.

(2) *The Groundwater Forest.* At the north end of the park a number of springs emerge from among lava boulders at the foot of the escarpment. These springs irrigate areas of closed canopy groundwater forest which is unrelated to the local climatic regime. The component tree species are large but probably rather short-lived. Within the forest there are freshwater swampsand glades of edaphic valley grassland. These are modified by indigenous grazing animals.

(3) *The alkaline lake.* The lake bed consists of deposites of alkaline silts, sands and clays which are exposed during periods of low lake levels but are inundated when the lake is high. Grasslands, including pure stands of sedge in boggy places, grow on these deposites, their extent and zonation depending on the varying level of the lake. These grasslands provide the most valuable pastures in the park.

THE FLORA

To date (1971) 671 species of flowering plants and 11 ferns have been found in the park. These are contained in 300 genera and 96 families. Further collecting and taxonomic work may add to the list but will not materially alter the statistics of the flora.

Of the 91 families of flowering plants 33 (36%) contain only 1 genus, 18 (20%) 2 genera, 30 (34%) 3–9 genera and 9 (10%) more than 10 genera.

The 9 largest families are Graminae (42 genera), Compositae (34), Papilionaceae (20), Acanthaceae (18), Labiatae (11), Rubiaceae (11), Amaranthaceae (10), Asclepiadaceae (10) and Cucurbitaceae (10). These together contain 275 (44%) of the species.

Two hundred and seventy two (71%) of the genera contain only one species; 23 genera (6%) contain 5 or more species. The largest genera are *Cyperus* (12 species), *Euphorbia* (10), *Indigofera* (10), *Ipomoea* (10), *Justicia* (10), *Acacia* (9) and *Ficus* (9).

Two hundred and forty six (40%) of all the species collected in the park are classed as ruderals.

ACKNOWLEDGEMENTS

We wish to thank Dr. J. S. Owen, the former Director, and Mr. Ole Saibul, the present Director of the Tanzanian National Parks, and Dr. O. Starnes, Director of the East African Agricultural and Forestry Research Organization, for encouraging us to undertake a botanical and ecological survey of the Lake Manyara National Park and for their permission to publish the results. We wish also to thank our colleagues in the East African Herbarium and Tanzania National Parks for assistance in the collection, preparation and determination of specimens.

DICOTYLEDONS

17 **Ceratophyllaceae**

Submerged aquatic plants

Ceratophyllum submersum L.
S. herb aquatic (o) in pools G11869; 11256.

18 **Nymphaeaceae** Water lilies.

Nymphaea caerulea Savi.
S. herb aquatic (f) rainwater pools G11255.
N. lotus L.
S. herb aquatic (a) rainwater pools G11254.

23 **Menispermaceae** F. T. E. A. (1956)

Cissampelos mucronata A. Rich.
F. Liane with woody rootstock VFG 6870.

26 **Hydnoraceae**

Hydnora abyssinica Schweinf.
W. & E. parasite on roots of Acacia; a fungus-like plant with fleshy warted subterranean rhizome, flowers tubular, large flushed red and pink, occasionally seen appearing from cracks in the ground G11132.

28 **Piperaceae** Wild pepper.

Piper umbellatum L.
F. shrub (f) streamsides in forest shade G11020.

36 **Capparaceae** F. T. E. A. (1964) Capers.

Boscia salicifolia Oliv.
W. & E. tree (o) G11404.
Cadaba farinosa Forsk. ssp. *farinosa*
W. shrub (a) in dry places, fls. during dry season G10999; 10290.
Capparis fasicularis (Gilg.) De Wolf var. *elaeagnoides* (Gilg) De Wolf
W. shrub often scandent (a) fls. during dry season G12047.
C. tomentosa Lam.
E. & W. riverine shrub D342.
Cleome hirta (Klotzsch) Oliv.
W. herb ann. (f) ruderal G11242.
C. monophylla L.
W. herb ann. (o) ruderal G11157.
Gynandropsis gynandra (L.) Briq.
W. herb ann. (a) ruderal G11091.
Maerua angolensis DC.
E. shrub (o) G11805.
M. edulis (Gilg & Bened.) De Wolf
W. woody herb per. secondary sites (a) D328.
M. triphylla A. Rich. var. *johannis* (Volkens & Gilg) De Wolf
W. shrub (va) dominant in understory Acacia woodland, fls. during dry season G10945.
Thylachium africanum Lour.
W. shrub (va) throughout, fls. dry season G10988.

39 **Cruciferae** Stocks, Watercress etc.

Farsetia stenoptera Hochst.
W. herb ann. (o) ruderal G12018.
Rorippa nasturtium-aquaticum (L.) Hayek
Special sites, spring heads and streams herb (va) where occurring D90.

42 **Polygalaceae** Milk-wort.

Polygala erioptera DC.
W. herb ann. (a) ruderal G11317.
P. kilimandjarica Chod.
P. a geophyte in fire degraded derived woody grassland VFG6903.
P. sphenoptera Fresen.
W. herb ann. (o) ruderal G11367.

45 **Crassulaceae** Stone crop

Crassula alsinoides (Hook.f.) Engl.
E. herb per. (r) on rocks G11855.
Kalanchoe lanceolata (Forsk.) Pers.
E. herb succulent per. (a) rocky places G11892.
K. mitejea Le Bl. & Hamet
E. herb per succulent with purple spotted leaves (o) rocky places G11893.
Kalanchoe sp.
E. (in gorges) herb succulent D195.

54 **Aizoaceae** F. T. E. A. (1961).

Corbichonia decumbens (Forsk.) Exell
F. & W. herb ruderal D283.
Gisekia pharnaceoides L. var. *pharnaceoides*
W. herb ann. ruderal G11147.
Glinus lotoides L.
W. herb ann. locally (a) dry mud of water holes G11306.
Limeum viscosum (J. Gay) Fenzl. ssp. *viscosum*
W. herb ann. (f) ruderal G11283.
Mollugo nudicaulis Lam.
W. herb ann. (a) ruderal G11860.
Trianthema salsoloides Oliv.
A. herb ann. (f) ruderal lake shore G11214.
Zaleya pentandara (L.) C. Jeffrey
W. herb ann. (va) ruderal G11863.

56 **Portulacaceae** Portulaca.

Portulaca oleracea L.
W. herb per. (f) ruderal G11262.
P. quadrifida L.
W. herb ann. (f) ruderal G11128.
Talinum caffrum (*Thunb.*) Eckl. & Zey.
W. herb per. (f) ruderal G11127.
T. portulacifolium (Forsk.) Schweinf.
E. & W. herb ruderal D67.

57 **Polygonaceae** F. T. E. A. (1958). Docks.

Oxygonum sinuatum (Meisn.) Dammer
W. herb ann. (a) ruderal G11837.
Polygonum salicifolium Willd.
F. herb per. (o) stream sides G12038.
P. senegalense Meisn. f. *senegalense*
S. herb per. (o) pools G10955.
Rumex bequartii De Wild.
W. herb ruderal wet places D382.

61 **Chenopodiaceae** F. T. E. A. (1954) Goosefoot.

Chenopodium opulifolium (Schrad.) Koch & Ziz
W. herb ann.(o) ruderal G11081.

63 **Amaranthaceae** Amaranthus, Cock's comb.

Achyranthes aspera L.
W. herb per. (va) overgrazed waste land ruderal G11236.
Aerva lanata (L.) Schult.
W. herb per. (o) ruderal G11139.
Alternanthera pungens H. B. & K.
W. herb per. (a) ruderal G11198.
A. sessilis (L.) R.Br.
S. in F. herb per. (o) streamsides G11112.
Amaranthus dubius Thell.
E. herb ann. (f), ruderal stony places G11891.
A. graecizans L. ssp. *graecizans*
W. herb ann. (f) ruderal G11050.
Celosia schweinfurthiana Schinz
F. herb per. (f) cool moist places G11201.

Cyathula orthacantha (Hochst.) Schinz
W. & F. herb ann. (f) in clearings G11193.
Digera muricata (*L.*) *Mart.*
W. herb ann. (a) ruderal G11188.
Gomphrena celosioides Mart.
W. herb per. (r) in dry river bed G11391.
Psilotrichum elliottii Bak. & C.B. Cl.
W. herb per. (r) in dry river bed G11380.
Pupalia lappacea (L.) Juss.
W. herb scandent in shrub group (o) VFG6740.
Sericocomopsis hildebrandtii (C.B.Cl.) Schinz
E. herb or low shrub (a) stony ground open sites G11827.

66 **Zygophyllaceae**

Tribulus terrestris L.
W. herb ann. (va) ruderal G11146.

67 **Geraniaceae** F. T. E. A. (1971) Geraniums, Cranes-bills.

Pelargonium alchemilloides (L.) Ait. (Syn. *P. multibracteatum Hochst.*)
E. herb (o) top of rift wall amongst rocks D269.
P. quinquelobatum A. Rich.
E. herb top of rift wall (o) D221.

71 **Balsaminaceae** Balsams.

Impatiens rubromaculata Warb.
F. herb short-lived per. (f) cool wet shaded places VFG6430.

72 **Lythraceae**

Ammannia prieuriana Guill. & Perr.
S. herb (o) wet places G11270.

77 **Onagraceae** F. T. E. A. (1953)

Ludwigia abyssinica A. Rich. (Syn. *Jussiaea abyssinica* (A. Rich.) Dandy & Brenan).
S. herb per. (f) pools and waterside sites G11053.
L. stolonifera (Guill. & Perr.) Raven, in *Reinwardtia*, **6:** 327 (1963).
S. herb per. (f) wet muddy places G11194.

83 **Nyctaginaceae**

Boerhavia coccinea Mill.
W. herb per. (va) ruderal G12084.
B. erecta L.
W. herb per. (va) ruderal G11222.
B. repens L.
W. herb ruderal D249B.
Commicarpus plumbagineus (Cav.) Standl.
W. herb semi-scandent (a) ruderal G11884.

93 **Flacourtiaceae** Kei Apple family.

Dovyalis macrocarpa Bamps
W. & F. shrub (f) G11042; 11312.
D. xanthocarpa Bullock.
W. & E. shrub (a) fls. dry season G10949.
Ludia sessiliflora Lam.
E. (riverine) shrub D376.
Oncoba spinosa Forsk.
E. shrub locally (f) at rocky base of escarpment G12034.
O. spinosa Forsk. var. *routledgei* (Sprague) Sleumer
E. & F. shrub or small tree (o) riverine at base of rift wall G10959.

95 **Canellaceae** F. T. E. A. (1956).

Warburgia ugandensis Sprague
E. tree (o) in riverine forest G11866.

101 **Passifloraceae** Passion-flower family.

Adenia cissampeloides Harms
E. shrub river gorge D123
A. schweinfurthii Engl. (Syn. *A. lobata* (Jacq.) Engl.).
F. liane (o) G11067.
A. volkensii Harms.
E. shrub (o) G11136.
A. wrightiana (Well.) Engl.
W. herb scandent (a) ruderal G11293.
Tryphostemma sp.
W. herb (o) G11883.

103 **Cucurbitaceae** F. T. E. A. (1967) Cucumbers.

Citrullus lanatus (Thunb.) Mansf.
W. herb (r) dry water course G11818.
Coccinia grandis (L.) Voigt.
W. vine per. (f) G11123; 11030; 10952.
Corollocarpus epigaeus (Rottl.) C.B.Cl.
Vine Chem Chem G13191.
Ctenolepis cerasiformis (Stocks) Hook. f.
E. vine (o) G11291. D187.
Cucumis aculeatus Cogn.
Msasa Gorge fruit only D111 a.
C. dipsaceus Spach.
W. vine per. (f) G11049. D134.
C. figarei Naud.
W. vine ann. (f) dry water course G11880.
Diplocyclos palmatus (L.) C. Jeffrey
F. herb climbing D322.
Kedrostis foetidissima (Jacq.) Cogn.
Endabash R. delta G11835.
K. hirtella (Naud.) Cogn.
W. vine (o) G12040; 6961.
Lagenaria siceraria (Molina) Standley.
W. vine (a) G11212. D135; 293.
L. sphaerica (Sond.) Naud.
E. vine per. (f) G12035. D292.
Peponium vogelii (Hook. f.) Engl.
F. herb climbing D281.
Zehneria scabra (L.f.) Sond.
F. & W. herb climbing D287.

114 **Ochnaceae**

Ochna ovata O. Hoffm.
E. shrub (f) G11055.

118 **Myrtaceae** Clove family

Syzygium guineense (Willd.) DC.
F. tree (o) riverine G12021.

121 **Combretaceae**

Combretum molle G. Don.
E. & P. tree fire degraded woodland (a) VFG 5999.
Terminalia brownii Fresen.
E. tree (a) woodland on slopes and in gorges G10985.

126 **Guttiferae**

Garcinia livingstonei T. Anders.
F. tree (o) in river gorges G11372.

128 **Tiliaceae** Jute family.

Corchorus tridens L.
E. herb ann. (a) ruderal G11244.
C. trilocularis L.
E. herb ann. (o) ruderal G11898
Grewia mollis Juss.
E. and W. shrub (f) D333.

G. tembensis Fresen. v. *kakothamnos* (K. Schum.) Burret
E. shrub (f) G11130.
G. trichocarpa A. Rich.
P. & E. shrub or small tree (f) rocky outcrops G12026.
G. villosa Willd.
E. shrub (f) G11131.
Triumfetta flavescens A. Rich.
W. shrub ruderal (a) G11014.
T. rhomboidea Jacq.
W. shrub ruderal (a) G11313.

130 **Sterculiaceae** Cola, Cocoa family

Dombeya kirkii Mast. (Syn. *D. umbraculifera* K. Schum.)
E. tree locally (f) D163.
Hermannia glanduligera K. Schum.
W. herb per. (f) ruderal G11005.
H. uhligii Engl.
W. herb woody per. (a) ruderal G11832.
Melhania velutina Forsk.
W. herb woody per (f) ruderal G11300.
Sterculia stenocarpa H. Winkl.
E. tree (a) G11407; 12019.
Waltheria indica L.
Woody herb Ndala River G13192.

131 **Bombacaceae** Baobab.

Adansonia digitata L.
E. tree (f) woodland thicket escarpment face and lower slopes occasionally to lake shore in *Acacia tortilis* woodland G10953.

132 **Malvaceae** Mallows, Cotton family.

Abutilon angulatum Mast.
E. woody herb D257.
A. bidentatum Hochst.
W. robust herb (f) ruderal VFG5962.
A. grandiflorum G. Don
Woody herb robus (f) G11368.
A. hirtum (Lam.) Sweet
W. herb robust per. (f) ruderal VFG 5963.
A. ramosum (Cav.) Guill. & Perr.
E. and W. herb woody per. (f) ruderal VFG5964.
Azanza garckeana (F. Hoffm.) Exell & Hillcoat
P. shrub or small tree (a) fire degraded wooded grassland VFG 6900.
Hibiscus calophyllus Cav.
W. & F. shrub (a) G11111.
H. cannabinus L.
E. and river delta herb ann. (o) ruderal G11820.
H. dongolensis Del.
W. shrub (f) G11124.
H. micranthus L.f.
W. herb woody per. (a) ruderal G11000.
H. palmatus Forsk.
E. herb ann. (o) G11864.
H. panduriformis Burm. f.
F. & W. shrub D162.
H. vitifolius L. ssp. *vulgaris* Brenan & Exell.
E. herb ann. (o) ruderal waste ground G11363.
Pavonia patens (Andr.) Chiov.
W. herb woody per. (a) ruderal G11008.
Sida acuta Burm. f.
E. herb woody ann. (o) silt river delta G11910.
S. alba L.
Herb woody, Endabash River drift G11210; 11297.
S. ovata Forsk.
W. herb woody per. (va) ruderal G11285.
Wissadula periplocifolia (L.) C. Presl.
F. herb woody ann. (a) ruderal G11800.

133 **Malpighiaceae** F. T. E. A. (1968)

Caucanthus auriculatus (Radlk.) Niedenz.
E. scandent shrub (f) G13252.

136 **Euphorbiaceae** Spurge family.

Acalypha fruticosa Forsk.
W. & E. shrub (va) throughout acacia woodland G11033.
A. indica L.
F. herb ann. (f) ruderal G11165.
A. ornata A. Rich.
F. herb woody (a) forest shade G11063.
Bridelia micrantha (Hochst.) Baill.
F. tree (a) ground water forest riverine G11114
Croton dichogamus Pax
E. shrub (f) in deciduous woodland VFG6902.
C. macrostachyus Del.
F. tree locally (a) pioneer forest edges and riverine G11210.
C. megalocarpa Hutch.
F. tree (f) riverine G10992.
C. scheffleri Pax
E. shrub (va) woodland-thicket G11035.
Drypetes natalensis (Harv.) Hutch.
F. tree (f) ground water forest G10964.
Euphorbia candelabrum Kotschy
E. tree (f) Sight record.
E. crotonoides Boiss.
W. herb (f) ruderal D242.
E. hirta L.
W. herb ann. (f) ruderal waste ground G11328.
E. heterochroma Pax
E. shrub spiny succulent locally (a) in thicket G11918.
E. inaequilatera Sond.
W. herb ann. (f) ruderal waste ground G11207.
E. nyikae Pax
E. tree succulent G11847.
E. scheffleri Pax
E. shrub (f) deciduous woodland thicket G11162.
E. spinescens Pax
E. shrub (f) deciduous woodland thicket G10947.
E. tetracanthoides Pax
E. herb succulent spiny D334. (very likely conspecific with *E. heterochroma*).
E. tirucalli L.
E. shrub locally (f) in thicket woodland. Sight record.
Jatropha fissispina Pax
E. shrub (o) disturbed ground G12025.
Phyllanthus engleri Pax
P. small tree (f) rocky ridges VFG6006.
P. fischeri Pax
F. shrub D248.
P. maderaspatensis L.
E. herb woody (a) G11171.
P. odontadenius Muell. Arg.
F. & W. herb D248.
P. reticulatus Poir.
P. shrub to 2m (f) fire degraded wooded grassland VFG6893.
P. sepialis Muell. Arg.
W. & E. shrub (va) in understory G11899.
Ricinus communis L.
W. robust herb or subshrub (a) ruderal redistributed silt G11324.
Tragia benthamii Bak.
P.E. & W. herb trailing (f) with urticating hairs. G11048.
T. brevipes Pax
F. & W. herb climbing D176.

146 **Caesalpiniaceae** F. T. E. A. (1967). Cassia, Tamarind,

Cassia absus L.
W. herb ann. (f) ruderal G11299.

C. didymobotrya Fresen.
F. shrub (o) ruderal riverine silt banks and disturbed places. Sight record.
C. hilderbrantii Vatke.
P. herb (f) hillside rocky ground MR24300.
C. italica (Mill.) F. W. Andr. ssp. *micrantha* Brenan
E. herb (a) ruderal G11085.
C. mimosoides L.
E. herb ann. (f) ruderal disturbed ground G11390.
C. occidentalis L.
W. herb robust ann. (o) ruderal G11289.
Delonix elata (L.) Gamble
E. tree (o) and local in ravines G11366.
Tamarindus indica L.
F. & W. tree (a) riverine G11077.

147 **Mimosaceae** F. T. E. A. (1959) Acacia and Mimosa, thorn-trees.

Acacia albida Del.
W. tree (a) in localised mature stands riverine G11225.
A. clavigera E. May. ssp. *usambarensis* (Taub.) Brenan
F. tree edges of ground water forest and riverine in gorges (a) G11216.
A. ethaica Schweinf. ssp. *platycarpa* Brenan
E. tree (f) marginal to thicket woodland G11172.
A. hockii De Wild.
E. & P. tree (a) fire degraded woodland VF6103.
A. mellifera (Vahl) Benth. ssp. *mellifera*
E. & P. tree (a) marginal to thicket woodland G11206.
A. schweinfurthii Brenan & Exell var. *schweinfurthii* (Syn. *A. brevispica Harms*).
F. & E. scandent shrub (va) thicket woodland G11774.
A. sieberiana D.C. var. *vermoesenii* (De Wild.) Keay & Brenan
W. & F. tree (a) widespread G11004.
A. tortilis (Forsk.) Hayne ssp. *spirocarpa* (A. Rich.) Brenan
E. & W. tree (va) dom. in woodland below and above escarpment fls. during dry season G11195.
A. xanthophloea Benth.
W. & F. tree (va) occurring in groves high watertable sites G11771.
Albizia amara (Roxb.) Boiv. ssp. *sericocephala* (Benth.) Brenan
P. & E. shrub or small tree (f) fire degraded wooded grassland or ridges D358.
A. anthelmintica Brongn.
E. tree (f) G11921.
A. zimmermannii Harms
F. tree (f) G12925.
Dichrostachyus cinerea (L.) Wight & Arn. ssp. *nyassana* (Taub.) Brenan
P. shrub (f) fire degraded derived wooded grassland VFG6892.
Entada abyssinica (Steud.) A. Rich.
E. tree rocky sites upper part of rift wall (r) G11859.

148 **Papilionaceae** F.T.E.A. (1971) Beans and Peas.

Aeschynomene indica L.
S. herb ann. (f) wet places G11816.
Alysicarpus glumaceus (Vahl) DC. ssp. *glumaceus*
E. herb ann. (o) ruderal disturbed ground G11392.
Calpurnia aurea Benth.
F. shrub (f) marginal secondary growth G12061.
Canavalia virosa Wight & Arn.
F. liane (o) G11163.
Clitoria ternatea L.
E. herb scandent per. (a) secondary sites G12055.
Crotalaria cephalotes A. Rich.
E. herb ann. (r) disturbed ground G11819.
C. goodiformis Vatke
E. herb river gorge D284.
C. incana L. ssp. *incana*
E. & W. herb ruderal D145.
C. incana L. ssp. *purpurascens* (Lam.) Milne-Redh.
W. herb ann. (f) ruderal disturbed ground G11211.
C. laburnifolia L.
E. shrub (o) ruderal disturbed ground G11824.
C. oocarpa Bak. ssp. *microcarpa* Milne-Redh.
E. herb ann. (f) disturbed ground G11888.

C. polysperma Kotschy
W. herb (f) secondary growth G11287.
Dalbergia melanoxylon Guill. & Perr.
P. & E. tree (f) fire degraded woodland above rift wall G11403.
D. nitidula Bak.
PE. tree with rough fissured dark almost black bark, flowers white in dense clusters(o) VFG6894.
Desmodium repandum (Vahl) DC.
F. herb in shade D25.
Dolichos oliveri Schweinf.
E. herb woody ruderal D272.
Glycine wightii (Wight & Arn.) Verdc. ssp. *wightii* (Schweinf.) Verdc.
W. herb per. climber (o) ruderal disturbed ground G11872.
Indigofera ambelacensis Schweinf.
W. herb per. (a) ruderal disturbed ground G11821.
I. arrecta A. Rich.
F. & W. subshrub (a) ruderal G11229.
I. colutea (Burm. f.) Merr. var. *colutea*
W. herb ann. locally (a) ruderal disturbed ground G11241.
I. costata Guill. & Perr. ssp. *goniodes* (Bak.) Gillett
W. herb ann. (o) ruderal disturbed ground 11310.
I. lupatana Bak. f.
W. & E. herb woody based per. (o) ruderal near hot spring G13234.
I. schimperi Jaub. & Spach. var: *schimperi*
P. herb per. (o) granitic rocks MR24297.
I. schimperi Jaub. & Spach. var: *baukeana* (Vatke) Gillett
E. herb per. (o) ruderal disturbed ground G11159.
I. swaziensis Bolus var: *perplana* (N.E.Br.) Gillett
P. herb woody based per. (o) granitic rocks MR24301.
I. tinctoria L.
F. & W. subshrub (a) throughout G11121.
I. volkensii Taub.
W. herb scandent (a) ruderal G11307.
Lonchocarpus eriocalyx Harms
P. & E. tree (f) in drainage gullies and fire degraded wooded grassland G11058.
Neorautanenia mitis (A. Rich.)Verdcort
P. per. tuberous rooted herb with a large tuber, stems several up to 4ft. tall (o) VFG6897.
Ophrestia hedysaroides (Willd.) Verdc.
W. herb per. (o) disturbed ground G11156.
Rhynochosia densiflora (Roth) DC. ssp. *chrysadenia* (Taub.) Verdc.
E. herb scandent D133.
R. malacophylla (Spreng.) Boj.
E. base of rift wall (f) scandent herb in secondary vegetation G12052.
Rothia hirsuta (Guill. & Perr.) Bak.
W. herb (o) ruderal disturbed ground G11309.
Sesbania goetzei Harms.
Shrub, Maji Moto (r) G13197.
S. sesban (L.) Merr. spp. *sesban* var. *nubica* Chiov.
S. shrub (a) river courses G10954.
Tephrosia elata Deflers. var. *elata.*
W. herb woody (f) ruderal disturbed ground G11825.
T. subtriflora Bak.
E. herb ruderal D131.
T. uniflora Pers.
E. & W. herb ruderal D156.
T. villosa (L) Pers. ssp. *ehrenbergiana* (Schweinf.) Brummitt.
W. herb ann. (a) ruderal disturbed ground VFG4866.
T. villosa (*L.*) Pers. var: *incana.*
W. herb ann. (a) disturbed ground G11094.
Teramus labialis (L.f.) Spreng. ssp. *arabicus* Verdc.
W. herb climbing (a) G11318.
Vigna frutescens A. Rich.
E. herb per. decumbent (f) G11919.
Vigna frutescens A. Rich.
E. & W. twining and decumbent per. herb (f) G11919.
V. luteola (Jacq.) Benth.
S. herb twining (a) marginal wet places G11839.
Xeroderris stuhlmannii (Taub.) Mendonca & E. P. Sousa
E. tree (f) in fire degraded wooded grassland G13196.

165 **Ulmaceae** F. T. E. A. (1966).

Celtis africana Burm. f.
F. tree (f) ground water forest G11138.
C. zenkeri Engl.
E. & F. tree (o) riverine forest G12033.
Chaetacme aristata Planch.
F. tree (f) groundwater forest G13200.
Trema orientalis (L.) Bl.
F. tree (a) groundwater forest G11019.

167 **Moraceae** Fig family.

Antiaris toxicaria (Pers.) Lesch.
F. tree (f) ground water forest G11024; 11369.
Cardiogyne africana Bureau.
W. shrub locally (a) alluvium G10990.
Chlorophora excelsa (Welw.) Benth. & Hook. f. '*Mvule*'.
F. tree (r) forest relic much cut formerly G10958.
Dorstenia sp.
E. (riverine) herb D196.
Ficus capensis Thunb.
F. tree (f) ground water forest D387.
F. capreaefolia Del.
F. riverine tree; formerly a dominant in thicket Msasa river delta now killed by high lake level G12044.
F. exasperata Vahl
F. tree (o) groundwater forest G12060.
F. glumosa Del.
P. & E. tree (a) rocky places on rift wall VFG6098; 7010.
F. ingens Miq.
E. shrub (f) cliffs G12072.
F. natalensis (Miq.) Hochst.
F. tree (a) groundwater forest G11125.
F. sycomorus L.
F. tree (a) in groups springs and streams throughout groundwater forest G11399.
F. vallis-choudae Del.
F. tree (o) at spring heads G12059.
F. wakefieldii Hutch.
F. tree (f) riverine and gorges in escarpment G11364; 12046.

169 **Urticaceae** Nettles.

Fleurya aestuans (L.) Miq.
F. herb ann. (a) in shade G11192.
Girardinia heterophylla (Vahl) Decne. ssp. *adoensis* (Steud.) Cuf. F. herb in shade D40.
Obetia pinnatifida Bak. Nettle-tree.
E. tree (f) in thicket woodland on steep slopes G11372.

173 **Celastraceae**

Hippocratea paniculata Vahl
F. liane (a) alluvium Endabash G10292; 11346.
Maytenus senegalensis (Lam.) Exell
P. shrub or small tree (a) fire degraded wooded grassland VFG6004; 6909.
Pleurostylia africana Loes.
P. & E. tree (f) escarpment valleys and granitic rocks brink of rift wall G11848. VFG6904.

179 **Icacinaceae**

Apodytes dimidiata Bernh.
P. tree (f) granitic rock outcrop VFG6005.

180 **Salvadoraceae** F. T. E. A. (1968).

Azima tetracantha Lam.
W. shrub (o) D316.
Salvadora persica L. var. *pubescens* Brenan. Mswaki, 'tooth-brush' brush
W. shrub (va) throughout G10946.

182 **Olacaceae** F. T. E. A. (1968)

Ximenia americana L..
E. shrub (f) dry slopes G11013.
X. caffra Sond.
E. shrub D330.

183 **Opiliaceae** F. T. E. A. (1968).

Opilia campestris Engl.
E. tree (f) river gorge slopes G11057.
O. celtidifolia (Guill. & Perr.) Walp.
W. liane (o) base of rift wall G11037.

185 **Loranthacae** Mistletoe family.

Erianthemum ulugurense (Engl.) Danser var *foliaceum* (Sprague) Balle
F. parasite on *Trichilia* G11261.
Helixanthera kirkii (Oliv.) Danser.
F. & W. parasite on *Grewia* and *Cordia* G11187.
Loranthus (*Tapinanthus*) *oehleri* Engl.
E. parasite on *Euphorbia heterochroma* and *E. tirucalli* G13238.
Odontella fischeri (Engl.) Balle
E. parasite on *Thylachium* G11402.
Plicosepalus curviflorus (Benth.) Van Tiegh
W. parasitic on *Acacia tortilis* ssp. *spirocarpa* G10971.
Tapinanthus sansibarensis (Engl.) Danser var. *kendelii* (Engl.) Balle
E. parasitic shrub (o) VFG6898.
Tapinanthus sp.
E. parasite on *Euphorbia* G12895.
Tapinostemma acaciae (Zucc.) Van Tiegh.
E. parasitic (o) VFG6007.

186 **Santalaceae** Sandalwood family.

Osyridicarpos schimperanus (Hochst.) A.DC.
E. scandent (o) bush group thickets fire-degraded wooded grassland crested of rift wall VFG6102.
Osyris compressa (Berg.) A.DC.
E. shrub or small tree (o) on crest of rift wall G11175.

190 **Rhamnaceae** Cascara, Christ's thorn.

Helinus integrifolius (Lam.) Kuntze var. or hybrid with *H. mystacinus* (Ait.) Steud.
E. & W. liane (o) throughout G11260.
Ventilago diffusa (G. Don) Exell
E. & W. liane (f) riverine G11190; 11018.
Ziziphus mucronata Willd.
W. tree (f) riverine G11325.
Z. pubescens Oliv.
F. & W. tree (va) riverine alluvium G10991.

193 **Vitaceae** Vine family.

Cissus petiolata Hook. f.
F. liane (o) in groundwater forest G12039.
C. rotundifolia (Forsk.) Vahl
P. herb scandent succulent (f) relict thicket among granitic boulders VFG7016.
C. quadrangularis L.
P. & E. liane (a) thicket woodland and granitic rocks G11274.
Cyphostemma cyphopetalum (Fresen.) Wild & Drum.
E. vine (f) G12027.
Rhoicissus tridentata (L.f.) Wild & Drum.
E. liane with 3-foliolate leaves, on granite boulders, locally (f) VFG7015.

194 **Rutaceae** Orange (*Citrus*) family.

Clausena anisata (Willd.) Benth.
E. shrub (f) top of rift wall among granitic boulders D389. VFG7004.
Fagara chalybea (Engl.) Engl.
P. & E. tree (f) in thicket woodland and rock groups G12023.

Toddalia asiatica (L.) Lam.
F. (riverine) liane. Sight record.
Vepris uguenensis Engl.
E. & W. shrub (a) throughout in understorey G11046; 11047.

195 **Simaroubaceae**

Harrisonia abyssinica Oliv.
P. & E. shrub locally (a) on rift wall G10987.

195A **Balanitaceae** Desert date.

Balanites aegyptiaca (L.) Del.
W. tree often co-dominant with *Acacia tortilis* throughout G10948.

196 **Burseraceae** Myrrh

Commiphora africana (A. Rich.) Engl.
P. small tree (a) stony ridges fire subclimax open woodland VFG6002; 7005.
C. baluensis Engl.
E. tree (a) in thicket woodland G11154.
C. campestris Engl.
E. tree (o) in thicket woodland G11059.
C. engleri Guill.
E. tree (a) in thicket woodland G11011. VFG 7007.
C. madagascariensis Jacq.
E. tree (f) in thicket woodland G11408.
C. schimperi (Berg.) Engl.
P. & E. tree (a) in thicket woodland and fire degraded wooded grassland G11185.
C. zimmermannii Engl.
E. tree (o) in thicket woodland G13237.

197 **Meliaceae**

Ekebergia capensis Sparrm.
F. tree locally (f) riverine G12043.
Trichilia roka (Forsk.) Chiov.
F. tree (va) a dominant in groundwater forest and riverine G11126.

198 **Sapindaceae**

Allophylus africanus Beauv.
P. & E. small tree to 5m or fire scorched coppice growth (va) VFG6891.
A. rubifolius (A. Rich.) Engl.
F. tree or shrub (a) riverine and understorey groundwater forest G11227; 11826.
Blighia unijugata Bak.
F. tree (o) riverine G11041.
Cardiospermum halicacabum L.
W. vine (o) marginal areas G11288.
Pappea capensis (Spreng). Eckl. & Zeyh.
P. tree occurring crest of rift wall fire-degraded wooded grassland VFG5997; 7003.
Zanha golungensis Hiern
F. tree (f) in groundwater forest G11045.

205 **Anacardiaceae**

Heeria reticulata (Oliv.) Engl.
P. & E. small tree (a) crest of rift wall and fire-degraded wooded grassland VFG6895.
Lannea stuhlmannii (Engl.) Engl.
E. tree (a) crest of rift wall G12057.
Rhus natalensis Krauss
P. shrub (a) ridges and among boulders D329.
R. vulgaris Meikle
P. shrub or small tree (f) rocky ridges VFG5998.
Sclerocarya birrea (A. Rich.) Hochst.
E. tree (a) crest of rift wall valleys and hillsides fire-degraded woodland G11155.
Sorindeia madagascariensis DC.
F. (riverine) tree D359.

213 **Umbelliferae** Parsley family

Berula erecta (Huds.) Cav.
S. herb per. aquatic (a) springs and streams G10960.
Centella asiatica (L.) Urban
S. herb per. aquatic (a) stream sides and wet mud G11115.
Heteromorpha trifoliata (Wendl.) Eckl. & Zeyh.
E. shrub (f) rocky sites D318.
Hydrocotyle ranunculoides L.f.
S. herb per. aquatic (a) G11341.
Steganotaenia araliacea Hochst.
E. shrub or small tree (o) D331.

221 **Ebenaceae** Ebony

Diospyros abyssinica (Hiern) F. White
F. tree (o) riverine G11044.
Euclea divinorum Hiern
E. F. tree (f) G11806. VFG7009

222 **Sapotaceae** F. T. E. A. (1968). Gutta-percha tree.

Mimusops kummel A.DC.
F. tree (r) riverine G11876.

228 **Loganiaceae** F. T. E. A. (1960)

Nuxia oppositifolia (Hochst.) Benth.
E. tree (o) riverine G11823.
Strychnos lucens Bak.
F. liane (f) riverine G11022. D377.
S. mitis S. Moore
F. tree (f) riverine G11867.
S. potatorum L. f.
E. tree (f) foot of rift wall south of Maji Moto G12074.

229 **Oleaceae** F. T. E. A. (1952). Jasmine.

Jasminum fluminense Vell. ssp. *holstii* (Gilg) Turril
F. liane (o) riverine G11836.

230 **Apocynaceae** Frangipani family.

Landolphia ? buchananii (Hall.f.) Stapf
E. (river gorge) liane D367.
Rauvolfia caffra Sond.
F. tree (a) in groundwater forest G10996.
Saba florida (Benth.) Bullock
E. shrub river gorge D368.
Tabernaemontana usambarensis K. Schum.
F. tree (va) in ground water forest G1029B; 10965.

231 **Asclepiadaceae** Milk weeds.

Calotropis procera (Ait.) Ait.
Shrub (o) on disturbed ground in dry drainage lines G10969.
Caralluma dummeri N. E. Br.
E. herb succulent (o) open places G11103.
C. speciosa (N.E.Br.) N.E.Br.
E. herb succulent (r) open rocky places in thicket woodland G13244.
Ceropegia ballyii Bullock
E. succulent vine (f) deciduous thicket woodland G11065; 11137.
Cynanchum hastifolium N.E. Br.
W. vine (o) riverine G11282.
C. tetrapterum (Turcz.) R.A. Dyer
E. vine succulent (f) in thicket woodland G12022.
C. validum N.E.Br.
E. liane (o) G11012.
Dregea abyssinica (Hochst.) K. Schum.
F. liane (o) G11043.

Duvalia tanganyikensis Bruce & Bally
F. riverine herb succulent and procumbent sandy redistributed soil G11414.
Pachycarpus schweinfurthii (N.E.Br.) Bullock
P. & E. Per. tuberous rooted herb on fire denuded hillside (o) VFG6908.
Parquetina nigrescens (Afz.) Bullock
E. liane (o) thicket woodland G12073.
Pentarrhinum insipidum E. Mey.
W. vine (o) in *Acacia*-bush group woodland G11275; 11286.
Pentatropis spiralis (Forsk.) Decne.
W. & E. vine (o) G11273; 12041.
Secamone stenophylla K. Schum.
E. vine (o) in thicket woodland G12081. D354.

232 **Rubiaceae** Coffee family.

Arbulocarpus sphaerostigma (A. Rich.) Tennant
W. herb ann. (o) on disturbed ground redistributed soil G11267; 11393.
Canthium setflorum Hiern
E. shrub (f) woodland thicket rift wall G12088.
Gardenia jovis-tonantis (Welw.) Hiern
W. shrub (a) riverine and gullies G10970.
Kohautia caespitosa Schinz var. *amaniensis* (K. Schum.) Brem.
W. herb ann. (o) ruderal disturbed ground ecotones G11246.
K. coccinea Royle
E. herb top of rift wall (r) D143.
K. lasiocarpa Kl.
F. herb (a) on soda flats D239.
Oldenlandia fastigiata Brem.
E. herb ann. (f) ruderal disturbed ground alluvium G11248.
O. somala Chiov.
F. herb soda flats N.E. lake D238.
Pavetta dolicantha Brem.
E. shrub D127.
P. scandens Brem.
F. shrub (o) understorey groundwater forest G12096.
P. subcana Hiern
E. shrub (o) understorey drainage lines G11829.
Pentanisia ouranogyne S. Moore
E. herb per. (f) degraded vegetation on slopes G12056.
Pentodon pentander (Schum. & Thonn.) Vatke
S. herb semi aquatic D17.
Rubia cordifolia L.
P. & E. many stemmed scandent asperous herb per. (r) VFG7011.
Rytigynia sp.
E. shrub (f) thicket woodland G11134; 13231.
Tarenna graveolens (S. Moore) Brem.
E. & W. shrub (f) drainage lines and woodland thicket on rift wall G11088; 12077.
Vangueria acutiloba Robyns.
W. shrub (a) understorey riverine to edges of swamp G10296.

238 **Compositae**

Acanthospermum hispidum DC.
Herb ann. ruderal on waste ground G13236.
Adenostemma perrottiti DC.
S. herb ann. (f) ruderal G10961.
Ageratum conyzoides L.
W. herb ann. (a) ruderal disturbed places G10957.
Anisopappus holstii (O. Hoffm.) Wild
W. herb ann. (o) ruderal D306.
Aspilia mossambicensis (Oliv.) Wild
W. herb becoming woody based per. (o) ruderal G11338.
Athroisma hastifolium Mattf.
E. herb ann. (o) badly drained black soil G11173.
Bidens pilosa L.
W. herb ann. (a) ruderal disturbed ground G11331.
B. schimperi Sch. Bip.
W. herb ann. (a) seral vegetation G11804.
Blumea aurita (L.f.) Wight
F. herb ann. (o) ruderal G12020.

Conyza aegyptiaca (L.) Ait.
F. (Clearings) herb (f) ruderal D218; 226.
C. bonariensis (L.) Cronq.
W. herb ann. (f) ruderal redistributed and disturbed soil G12051.
Crassocephalum bojeri (DC.) Robyns
W. riverine herb per. scandent succulent D119.
C. picridifolium (DC.) S. Moore
F. herb per. (f) seral in clearings G11023.
Dicoma tomentosa Cass.
E. herb ann. (f) seral on redistributed soil G11205.
Eclipta prostrata (L.) L.
W. herb ann. (o) ruderal on alkaline soil G11272.
Emilia coccinea (Sims) Sweet
F. & W. herb ann. ruderal open sites D245.
Enydra fluctans Lour.
S. herb per. (a) in pools G12065.
Epaltes alata (Sond.) Steetz.
W. herb ann. (f) ruderal sandy places G11238.
Erlangea cordidifolia (Benth.) S. Moore
W. & E. herb ann. (f) ruderal G11917.
Galinsoga parviflora Cav.
W. herb ann. (o) widespread ruderal G11314.
Gnaphalium luteo-album L.
E. herb per. (o) crest of rift wall G11830.
Helichyrysum glumaceum DC.
W. herb per. (o) ruderal G11895.
Hirpicium diffusum (O. Hoffm.) Roess.
F. herb D235.
Melanthera scandens (Schum. & Thonn.) Roberty ssp. *madagascariensis* (Bak.) Wild
F. herb per. (a) open places in river fringe G10976.
Microglossa oblongifolia O. Hoffm.
E. shrub (f) secondary in thicket-woodland G11009.
M. pyrifolia (Lam.) O. Ktze.
F. herb D326.
Mikania cordata (Burm.f.) B.L.Rob.
F. herb scandent locally (a) secondary in clearings G11913.
Nidorella pedunculata Oliv. & Hiern
E. herb D227.
Notonia abyssinica A. Rich.
E. herb succulent perennial (o) in thicket G11852.
N. coccinea Oliv. & Hiern
P. & E. per tuberous rooted herb with fleshy fusiform leaves, scattered in fire-degraded wooded grassland (f) VFG6960.
Pluchea bequaertii Robyns
W. shrub (o) ecotones alkaline soil G10984.
P. dioscoridis DC.
W. shrub (a) ecotones alkaline soil G10968.
P. nitens O. Hoffm.
W. herb ann. (o) ruderal redistributed soil G11233.
P. ovalis DC.
W. shrub (a) secondary riverine G11897.
P. sordida (Vatke) Oliv. & Hiern
F. shrub D339.
Porphyrostemma grantii Benth.
A. herb on soda flats D237.
Senecio coronopifolius Desf.
W. herb (f) ruderal D225B.
S. petitianus A. Rich.
E. shrub scandent in woodland thicket D371.
Sonchus asper (L.) Hill
W. herb ann. (o) ruderal disturbed places G11333.
Sphaeranthus bullatus Mattf.
W. herb ann. (a) ruderal rocky gorge G10956.
S. cyathuloides O. Hoffm.
W. herb ann. (o) ruderal disturbed ground edges dry pools G11321.
S. suaveolens (Forsk.) DC.
W. herb ruderal D23.
S. ukambensis O. Hoffm.
W. herb per. (va) ruderal in ecotones and derived grassland G10989.

Spilanthes mauritiana (Pers.) DC.
S. herb (f) secondary sites with high water table G11025.
Tagetes minuta L.
W. herb ann. widespread alien (va) disturbed places G11377.
Tridax procumbens L.
W. herb per. (o) ruderal dry river bed and disturbed ground G11095.
Vernonia brachycalyx O. Hoffm.
E. shrub scandent (f) secondary in ecotones G11858.
V. cinerascens Sch. Bip.
P.E. & W. shrub (a) seral vegetation dry places G11160.
V. grantii Oliv.
E. shrub (o) seral rocky places dry river bed G11817.
V. pauciflora Less.
E. herb (f) secondary vegetation G11413.
V. peculiaris Verdc.
E. & W. herb ann. (f)-(a) seral secondary vegetation G11890.
V. stenolepis Oliv.
F. herb (o) in clearings G11302.
V. tephorodes A. Peter *in ed.*
E. herb per. locally (f) edges of escarpment woodland G11851.

239 **Gentianaceae** Gentian family.

Enicostema hyssopifolium (Willd.) Verdoorn
W. herb per. (f) ecotones between woodland and alkaline soils G11284.

241 **Plumbaginaceae** Plumbago family.

Plumbago zeylanica L.
F. herb (f) margins and clearings G11374.

244 **Lobeliaceae** Lobelia family.

Cyphia glandulifera A. Rich.
W. herb per. (o) ecotones and redistributed soil G11142.

249 **Boraginaceae** Borage family.

Cordia africana Lam.
F. tree (a) in ground-water forest G12091.
C. goetzei Guerke
W. shrub or tree (va) especially alluvium G11228.
C. ovalis R.Br.
W. shrub (va) throughout G11079.
C. sinensis Lam.
W. shrub or tree (va) especially alluvium G11186.
Ehretia amoena Klotzsch (Syn. *E. stulmannii* Guerke).
F. small tree occurring near springs D58.
E. obtusifolia DC.
E. shrub (f) thicket woodland on steep slopes G10986; 11056.
Heliotropium subulatum (DC.) Martelli.
W. herb per. (a) ruderal G11072.
Trichodesma zeylanicum (L.) R.Br.
E. herb ann. (o) ruderal G11092.

250 **Solanaceae** Potato family.

Capsicum annuum L.
F. herb ann. (o) casual G11833.
Datura stramonium L.
W. herb ann. (f) ruderal G11315.
Lycopersicum Esculentum Mill.
W. herb ann. (o) ruderal disturbed ground G11334.
Nicandra physaloides (L.) Gaertn.
W. herb ann. (o) ruderal G11396.
Physalis micrantha Link.
W. herb ann. (o) ruderal G11197.
Solanum dasyphyllum Thonn.
F. herb ann. (o) casual G11109.
S. incanum L.
W. herb woody (va) ruderal throughout G11158.

S. nigrum L.
W. & F. herb ann. (f) ruderal G11113.
S. renschii Vatke
E. shrub (o) ruderal D321.
S. setaceum Dammer
W. herb per. (f) ruderal in ecotones G11031.
Withania somnifera (L) Dunal
W. herb (f) ruderal secondary vegetation G11040.

251 **Convolvulaceae** F. T. E. A. (1963) Bindweed, Dodder and Morning Glory family

Astripomoea malvacea (Kl.) Hall. f. var *floccosa* (Vatke) Verdcort
P. & E. several stemmed per. herb with discolorous leaves (o) G. EAH. 13248; VFG6905.
Cuscuta kilimanjari Oliv.
F. herb parasite on Hypoestes D28.
Evolvulus alsinoides (L.) L.
E. herb (o) G11868.
Hewittia sublobata (L.f.) O. Ktze.
F. herb twining per. (f) open places G10963.
Impomoea arachnosperma Welw.
F. herb twining groundwater forest clearing D203.
I. cairica (L.) Sweet
F. herb climber per. (f) wet clearings G10978.
I. coptica (L.) Roem. & Schult. var. *coptica.*
W. herb ann. prostrate (o) in thicket G11279.
I. hildebrantii Vatke ssp. *hildebrandtii.*
W. herb per. (r) casual G11908.
I. kituiensis Vatke var. *masaiensis* (Pilg.) Verdc.
W. herb twining (o) riverine D117.
I. mombassana Vatke
W. herb twining (o) riverine D185.
I. nil (L.) Roth
F. vine (a) forest clearings G11191.
I. obscura (L.) Ker-Gawl. var. *obscura.*
F. herb twining (o) secondary vegetation G11912.
I. sinensis (Desr.) Choisy ssp. *blepharosepala* (A. Rich.) Meeuse .
W. herb twining D184.
I. spathulata Hall.f.
E. vine (o) secondary thicket woodland at foot of rift wall G11259. (An intermediate specimen between *I. kituiensis* and *I. spathulata.*)
Stictocardia incomta (Hall.f.) Hall.f.
F. vine (o) secondary vegetation G10983.
Turbina stenosiphon (Hall.f.) Meeuse var. *stenosiphon.*
W. vine (f) in river fringes G11215.

252 **Scrophulariaceae**

Alectra kirkii Hemsl.
E. herb parasite on grasses G13253.
A. vogelii Benth.
E. herb parasitic (f) G12935; 12936.
Buttonia hildebrantii Engl.
E. shrub scandent (o) thicket woodland G11082. VFG5436.
Craterostigma plantagineum Hochst.
E. herb per. (f) special sites open places G11078.
Rhamphicarpa heuglinii Hochst.
W. herb per. (o) grass sward ecotones G11007.
Striga asiatica (L.) O. Ktze.
W. herb parasite (a) ruderal fallows and waste places G11305.
S. gesneroides (Willd.) Vatke
E. herb parasite (o) ruderal G11870.
Veronica anagallis aquatica L.
W. herb ann. (o) dry season wet site in river bed VFG6429.

253 **Orobanchaceae** F. T. E. A. (1957) Broomrape.

Cistanche tubulosa (Schenk) Hook.f.
W. herb parasite (o) ecotones and elsewhere G11877.

257 **Bignoniaceae**

Kigelia africana (Lam.) Benth. Sausage-tree.
P.W. & F. tree (a) groundwater forest and riverine G11360.
Stereospermum kunthianum Cham.
E. tree. Sight record.

258 **Pedaliaceae** F. T. E. A. (1953)

Ceratotheca sesamoides Endl.
E. herb ann. (o) ruderal G11802.
Sesamum angustifolium (Oliv.) Engl.
W. herb (f) ruderal secondary vegetation G11298.

259 **Acanthaceae** Acanthus family.

Asystasia gangetica (L.) T. Anders.
F. herb semi-scandent (a) shade undergrowth and in clearings G11914.
A. schimperi T. Anders.
W. herb ann. (o) ruderal G11296.
Barleria eranthemoides C.B.Cl.
E. & W. herb woody (a) widespread G11208.
B. submollis Lindau
E. & W. herb woody and scandent (f) seral G11375.
B. volkensii Lindau
E. herb scandent per (o) seral rocky places G11801.
Blepharis maderaspatensis (L) Roth
W. herb procumbent or scandent (o) ruderal G11281.
Crabbea velutina S. Moore
E. herb per. (o) ruderal ecotones G11857.
Dyschoriste procumbens E.A. Bruce
E. herb woody per. (a) ruderal upper parts of rift wall G11405.
Ecbolium revolutum (L.) C.B.Cl.
E. herb woody per. (a) secondary vegetation G11401.
Hypoestes verticillaris (L.f.) R.Br.
F. herb per. (a) shade undergrowth G12093.
Isoglossa ovata E.A. Bruce
W. herb per. (a) ruderal in thickets G12099.
Justicia betonica L.
W. herb per. (a) ruderal G11411.
J. caerulea Forsk.
W. herb per. (o) ruderal in ecotones G11907.
J. cordata T. Anders.
W. shrub (va) throughout Acacia-bush group woodland G11122.
J. exigua S. Moore
W. herb per. ruderal D212.
J. fischeri Lindau
W. herb woody (a) ruderal G11129.
J. flava Vahl
W. herb per. (f) ruderal ectotones G11813.
J. glabra Roxb.
W. herb per. (a) in field layer seral G11258.
J. heterocarpa T. Anders.
W. herb ann. (o) ruderal disturbed ground G11335.
J. nyassana Lindau
F. herb (f) floor shade and clearings G11915.
J. striata (Klotzch) Bullock
W. herb per. (a) ruderal G11886.
Lipidagathis scabra (Lindau) C.B.Cl.
W. herb per. (o) in field layer seral G12094.
Monechma debile (Forsk.) Nees
W. herb ann. (a) in field layer seral G12083.
Neuracanthus sp.
E. herb per. (r) seral G11406.
Peristrophe bicalyculata Nees
W. herb ann. (a) in field layer seral G11234.
Phaulopsis imbricata (Forsk.) Sweet
F. herb per. (f) semi-shaded undergrowth G11916.

Pseuderanthemum hildebrandtii (Lindau) C.B.Cl.
F. shrub locally (a) shaded undergrowth G11199.
Ruellia megachlamys S. Moore
W. small shrub per. (va) throughout G11071.
R. prostrata T. Anders.
F. & W. herb woody per. seral (a) in ecotones G11290.
Ruttya fruticosa Lindau
E. shrub locally (a) rocky places G12087.
Thunbergia alata Sims
F. & W. herb climber (f) secondary sites D279.

263 **Verbenaceae** Verbena family

Clerodendrum rotundifolium Oliv.
F. shrub (f) secondary vegetation G12098.
Lantana rhodesiensis Moldenke
E. shrub (f) ruderal ecotones and secondary vegetation G11850.
L. viburnoides (Forsk.) Vahl
E. shrub (a) ruderal in secondary vegetation G11090. VFG7020.
Lippia javanica (Burm.f.) Spreng.
W. & F. shrub (f) ruderal invading secondary vegetation D327. VFG7019.
Phyla nodiflora (L.) Greene
S. herb per. (f) locally in wet places G12062.
Premna senensis Klotzch
W. shrub (f) bush-groups and riverine G11061.
Priva cordifolia (L.) Druce var. *flabelliformis* Moldenke
W. herb woody (a) ruderal G11119.
Vitex mombassae Vatke
P. small tree (f) rocky hillsides fire subclimax open woodland VFG6001.

264 **Labiatae** Mint family.

Becium kenyanum (Vatke) G. Taylor.
W. herb woody (a) ruderal G11003.
Coleus ignirius Schweinf.
E. shrub semi-scandent (a) rocky places thicket-woodland G11083. D291.
C. lasianthus Guerke
E. herb per. succulent locally (a) in thicket woodland G11923.
C. spicatus Benth.
W. herb D202.
Englerastrum sp. A of Upland Flora.
E. many stemmed succulent shrub with bright blue flowers (fo) G11151; 11295. VFG7013.
Hoslundia opposita Vahl
W. & F. shrub (a) ruderal invading secondary vegetation G10981.
Hyptis pectinata Poit.
F. herb per. (o) ruderal G11217.
Iboza multiflora (Benth.) E.A. Bruce
E. herb D304.
Leonotis africana (P. Beauv.) Briq.
E. & W. herb widespread ruderal D88A.
L. nepetifolia (L.) Ait.f.
W. herb ann. (a) ruderal disturbed ground G11879.
Leucas glabrata R.Br.
W. herb per. (a) ruderal ecotones G11144.
L. neuflizeana Courb.
F. herb ruderal D244.
Osimum suave Wild.
W. shrub (va) ruderal invading secondary vegetation throughout especially deltas G11073.
Orthosiphon parvifolius Vatke
W. herb D251; 355.
O. suffrutescens (Thonn.) Morton
W. herb woody (a) ruderal throughout G11002; 11062.
Plactranthus flaccidus (Vatke) Guerke
W. herb ann. (a) ruderal disturbed ground G11330.
P. parvus Oliv.
W. herb D277.
Tinnea aethiopica Kotschy & Peyr.
E. herb woody D370.

MONOCOTYLEDONS

280 **Commelinaceae**

Aneilema aequinoctiale (P. Beauv.) Kunth
E. herb D183.
A. petersii (Hassk.) C.B.Cl.
W. herb per. semi-scandent (f) riverine sites G11871.
Commelina africana L. var. *diffusa Brenan*
W. herb per. (a) ruderal disturbed ground G11400.
C. albescens Hassk.
W. herb per. (o) ruderal G11098.
C. benghalensis L.
F. herb per. (a) ruderal clearings G11218.
C. foliacea Chiov.
W. herb per. (a) ruderal G11074.
C. imberbis Hassk.
E. herb per. (a) ruderal G11161.

290 **Zingiberaceae** Ginger family.

Afromomum angustifolium (Sonn.) K. Schum.
F. herb per. locally (a) understorey ground-water forest wet place in shade G10298.

293 **Liliaceae** Lilies.

Aloe ballyi Reynolds
E. small tree with slender trunk (a) gregarious rocky places and cliffs G11776.
A. secundiflora Engl.
W. herb succulent (o) colonies in special sites G12097.
Aloe sp.
E. herb succulent (o) local groups rocky places G11854.
Asparagus africanus L.
E. herb scandent D50.
A. aethiopicus L. var. *angusticladus* Jessop
E. herb scandent (a) thicket-woodland G11410. D126.
A. setaceus (Kunth) Jessop
W. & F. herb per. scandent (a) throughout G11107. D43.
Dipcadi viride (L.) Moench.
W. & E. herb bulb (a) redistributed soil G11101; 11775.
Drimiopsis volkensii Bak.
E. herb bulb (o) G11105.
Gloriosa Superba L.
W. herb per. climber (r) G11814.
Ornithogalum longibracteatum Jacq.
W. herb bulb (o) G12937.
Scilla indica Bak.
E. herb bulb (f) local rock shelf G11064.
S. kirkii Bak.
E. herb bulb (f) local rock shelf G11064; 11168.
Urginea sp.
W. herb bulb (o) disturbed areas G11099.

296 **Pontederiaceae** F. T. E. A. (1968).

Heteranthera callifolia Kunth
S. herb per. (o) pools and mudholes G11257.

302 **Araceae** Aroids.

Pistia stratiotes L.
S. herb floating (a) on water in pools and lagoons G11340.

303 **Lemnaceae** Duck-weeds.

Lemna minor L.
S. herb (a) floating still pools G11066.
Spirodela polyrhiza (L.) Schleid.
S. herb (f) floating still pools G11342.
Wolffia repanda Hegelmaier
S. herb (a) floating still pools G11807.

305 **Typhaceae** F. T. E. A. (1971) Reed mace.

Typha dominaensis Pers.
S. herb (reed-like) (va) locally dominant where perennial rivers enter lake G11834.

306 **Amaryllidaceae** Amaryllis

Ammocharis tinneanus (Kotsch. & Peyr.) Milne-Redh. & Schweick.
E. herb bulb (f) badly drained shelf G13254.
Boophane disticha (L.f.) Herb.
P. bulbous perennial herb with an enormous bulb, leaves strap-shaped distichus, flowers dark red in a large globose head (o) VFG7017.
Haemanthus multiflorus Martyn.
F. herb bulb (f) groups in shaded understorey G10980.

313 **Agavaceae**

Sansevieria braunii Engl. & Kraus
E. herb per. succulent (o) D197 (sterile specimen and doubtful if correctly determined).
S. ehrenbergiana Bak.
E. herb per. succulent (va) in groups thicket woodland. Sight record.

314 **Palmae** Palms.

Elaeis guineensis Jacq. Oil palm.
F. palm sight record (Shimba river).
Hyphaene ventricosa Kirk Doumpalm.
W. palm (f) but very patchily distributed G10998.
Phoenix reclinata Jacq. Wild date palm.
F. palm (a) growing in clumps riverine and where high water table G11069.

326 **Orchidaceae** Orchids.

Ansellia gigantea Reichb. f. var. *nilotica* (Bak.) Summerh.
E. & F. epiphyte (f) often on baobab D383.
Eulophia orthoplectra (Reichb.f.) Summerh.
E. terrestrial (f) in thicket woodland G11167.
E. wakefieldii (Reichb. & S. Moore) Summerh.
E. terrestrial (o) G11133.

331 **Cyperaceae** Sedges.

Cyperus alternifolius L. ssp. *flabelliformis* (Rottb.) Kukenth.
F. herb per. gregarious (va) springs swamp edges and shade along streams G11865.
C. amabilis Vahl
W. herb ann. (a) ruderal disturbed ground G11308.
C. articulatus L.
S. herb (rush-like) (a) in groups swampy and boggy sites G10997.
C. difformis L.
S. per. tussock (f) wet ground VFG6507.
Cyperus distans L.f.
P.E. per. culms to 90 cm. bunch growth from fibrous roots with tubers (o) in stormwater channel, VFG. 7018.
C. immensus C.B.Cl.
S. herb per. (tussock-growth) (va) seasonally wet sites G10974.
C. laevigatus L. (Syn. *Juncellus laevigatus* (L) C.B.Cl.).
S. (alkaline) herb per. (va) a dominant lake shore and alkaline bogs G11010.
C. latifolius Poir.
S. per. special site spring-head bog VFG6433.
C. longus L. ssp. *tenuiflorus* (Rottb.) Kukenth.
S. herb per. (f) boggy sites G11028.
C. merkeri C.B.Cl.
S. per. special site spring-head bog VFG. 6434.
C. obtusiflorus Vahl
W. herb per. (f) ruderal disturbed silt G11093.
C. rotundus L.
F. & W. herb per. (f) ruderal wet places and ecotones G11145. VFG6885.
C. schimperianus Steud.
W. per. rhizomatous (o) wet sand in river bed VFG6367.
C. teneriffae Poir.
W. herb ann. (f) ruderal ecotone and lake shore G11117.

Fimbristylis exilis (H.B. & K.) Roem. & Schult.
W. herb ann. (f) ruderal disturbed sandy ground G11301.
F. ovata (Burm. f.) Kern
P. per. bulbous based (o) fire subclimax wooded grassland VFG6101.
Fuirena leptostachya Oliv.
S. herb (o) ruderal special sites seasonally wet sand G11269.
F. pubescens (Lam.) Kunth
S. herb per. (a) wet ground perimeter of swamps G11026.
Kyllinga alba Nees.
E. herb per. (o) rocky pavement G11100.
K. oblonga C.B.Cl.
W. herb per. (a) ecotones in woodland and along lake shore G11075.
Kyllinga sp.
W. herb ann. locally (f) ecotones lake shore G11076.
Mariscus assimilis (Steud.) Podl.
S. ann. tussock herb, (o) on wet sandbanks, G11268.
M. dubius (Roth.) Hutch.
P. & E. per. (o) dry ledges VFG6979.
M. leptophyllus C.B.Cl.
E. herb per. (o) rocky places and dry ledges G11362. VFG 6979.
M. procerus A. Rich.
E. caespitose per. culms bulbous-based in small colonies between stones (o) burnt hill-sides VFG6899; 7008.
M. pseudovestitus C.B.Cl.
P. E. per culm bases 3-angular caespitose inflated and growing in drypapery leaf bases VFG6979.
M. vestitus (Krause) C.B.Cl.
E. per. growing in a dense clump, culm bases swollen and covered with dense brown fibrous leaf bases (o) VFG6888.
M. sp. aff. *M. taylori* C.B.Cl. (=A.B. 3402 in E.A. Herb.).
E. per. rhizomatous (f) secondary sites in thicket woodland VFG6505.
Pycreus elegantulus (Steud.) C.B.Cl.
S. herb per. special sites damp places (o) VFG6428.
P. mundtii Nees
S. herb per. (a) sward forming boggy places G11344.

331 **Gramineae** F. T. E. A. Part 1 (1969). Grasses of Tanganyika by D. M. Napper (1965).

Andropogon pratensis Hack.
per. casual river bed G11395. (f) fire subclimax grassland on rift wall VFG6094.
A. schinzii Hack.
P. per. fire-induced woodland grassland (a) on hillside VFG6958.
Aristida adscensionis L.
W. & E. ann. locally (a) ruderal sandy and stony ground, disturbed and degraded places G11203; 11388.
A. mutabilis Trin. & Rupr.
W. ann. (o) ruderal disturbed places G11381.
Bothrochloa insculpta (A. Rich.) A. Camus
W. & E. per. casual river bed G11149.
B. radicans (Lehm.) A. Camus
E. per. (f) secondary grassland badly drained sites G12045.
Brachiaria deflexa (Schumach.) C.E. Hubb.
F. ann. seral and ruderal G11166.
B. leersioides (Hochst.) Stapf
E. (o) ruderal roadsides (this specimen a stoloniferous perennial, plant 'mealy') VFG5321.
Cenchrus ciliaris L.
W. & E. per. branched tussock grass (a) seral and disturbed ground throughout G11120.
Chloris gayana Kunth
W. per. tussock grass (va) badly drained soils, ecotone between alkaline grassland and wood-landforest G11141.
C. pyconothrix Trin.
W. ann. (a) seral sandy soils, ruderal disturbed ground G11382.
C. roxburghiana Schult.
W. per. tussocks, culms branched and cane-like (va) sometimes co-dom, secondary/seral sites G11089.
C. virgata Sw.
W. ann. (a) seral/ruderal, in ecotones G11239.
Cymbosetaria sagittifolia (A. Rich.) Schweick.
W. ann. (f) ruderal disturbed sites in shade G11196.

Cymbopogon excavatus (Hochst.) Stapf
W. per. casual river bed G11874.
Cynodon dactylon (L.) Pers.
W. F. & A. per. (va) dom. on alluvial clay, clay-loams and sand where high water-table; pasture green all months G11140.
C. plectostachyus (K. Schum.) Pilg.
W. per. (va) dom. compacted sand and detritus G12082.
Cypholepis yemenica (Schweinf.) Chiov.
E. per. locally (f) ledges G13235.
Dactyloctenium aegyptium (L.) Beauv.
W. ann. (f) ruderal/seral G11237.
Digitaria milanjiana (Rendle) Stapf
W. per. (a) perimeter grassland, ecotones G12078.
D. secalarum (Schweinf.) Chiov.
W. & F. per. (va) co-dom. clay and silt, disturbed sites G12090.
D. setivalva Stent
W. per. (f) casual secondary sites, river bed G11276.
D. velutina (Forsk.) Beauv.
W. ann. (a) ruderal G12086.
Diplachne fusca (L.) Beauv.
A. per. locally (f) in wet mud-holes and channels G11232.
Echinochloa colonum (L) Link.
S. & W. ann. rainwater pools, wallows PKG22.
E. haploclada (Stapf) Stapf.
ann./per. locally dom. in rainwater pools and other temporary wet places G11808.
E. pyramidalis (Lam.) Hitchc. & Chase.
S. per. semi-aquatic locally (f)-(a) G11838.
Eleusine indica (L.) Gaertn.
ann. ruderal and casual river bed G11251.
Enneapogon cenchroides (Roem. & Schult.) C.E. Hubb.
W. & E. ann./per. (a) stony/sandy sites G11169; 11203.
Enteropogon macrostachyus (A. Rich.) Benth.
W. & E. per. (a) throughout seral in secondary sites G11336.
Eragrostis aethiopica Chiov.
W. & E. ann. (a) ruderal throughout G11861.
E. aspera Nees
W. ann. (a) ruderal throughout G11379.
E. cilianensis (All.) Lutati
W. ann. (f) river bed sand banks and ruderal throughout G11226.
E. superba Peyr.
W. & E. per. secondary (fire degraded) grassland (a) also ruderal G11150.
Eriochloa nubica (Steud.) Hack. & Stapf
W. ann. (f) water-holes and swamp edges G11809.
Eustachys paspaloides (Vahl) Lanza & Mattei
P. per. (f) in loose colonies in fire-induced woodland grassland on hillsides VF6959.
Hemarthria natans Stapf
W. per. (r) casual in river bed G11250.
Heteropogon contortus (L.) Roem. & Schult.
E. per. (a) seral fire-degraded grassland stony ground G11017.
Hyparrhenia cymbaria (L.) Stapf
E. per. (o) rocky sites deforested slopes G11856.
H. filipendula (Hochst.) Stapf var. *filipendula*.
E. & P. per. (va) dominant fire subclimax grassland VFG6088.
H. filipendula (Hochst.) Stapf var. *pilosa* (Hack.) Stapf
E. per. (va) fire subclimax grassland rift wall VFG6089.
H. papillipes (A. Rich.) Stapf (Syn. *H. lintonii* Stapf)
E. per. (f) in colonies rocky slopes G11853'
H. rufa (Nees) Stapf
per. (f) badly drained clay, wet places in ecotones G11345.
Hypethelia dissoluta (Steud.) W. D. Clayton (Syn. *Hyparrhenia dissoluta* (Steud.)Hutch.)
E. per. locally (a) fire-degraded vegetation on slopes G11849.
Leersia hexandra Sw.
S. per. locally (a) aquatic grass G11106.
Leptocarydium vulpiastrum (De Not.) Stapf
E. & W. ann. (a) ruderal G11247.
Leptochloa chinensis Nees
S. per. (o) water-holes G11815.
L. obtusiflora Hochst.
W. per. (f) secondary sites G11280.

Odyssea jaegeri (Pilg.) Robyns & Tournay
A. per. (va) beach of lake where periodically flooded G10288.
Oplismenus hirtellus (L.) Beauv.
F. & W. per. (a) in shade G11339.
Panicum deustum Thunb..
F. & E. per. (a) forest edges and clearings in partial shade G11224.
P. infestum Anderss.
P. per. (o) in loose colonies fire subclimax wooded grassland and stream sides VFG4708; 6887.
P. maximum Jacq.
W.E. & P. per. (a) throughout in deforested sites and on alluvium G11882.
P. meyerianum Nees
S. & W. per. locally (a) in pools G11015.
P. repens L.
S. per (va) in zone edges of wet places G11343.
P. trichocladum K. Schum.
F. per. scandent (o) forest edges G12089.
Paspalidium geminatum (Forsk.) Stapf
S. & A. per. (a) riverine and delta sites G10977.
Pennisetum mezianum Leeke
W. & E. per. (f) badly drained soils G11773.
P. purpureum Schumach.
Riverine per. (reed-like) (r) G11909.
Perotis patens Gand.
W. ann. ruderal waste land, ecotones G11240.
Rhynchelytrum repens (Willd.) C.E. Hubb.
E. & P. per. (f) ruderal disturbed ground G11016.
R. villosum (Parl.) Chiov.
ann. (o) casual secondary sites and river bed G11387.
Schmidtia pappophoroides J. A. Schmidt (Syn. *S. bulbosa* Stapf).
E. per. (f) secondary sites on ledges G12050.
Sehima nervosum (Rottb.) Stapf
E. per. (f), casual in river bed silt G11384.
Setaria homonyma (Steud.) Chiov.
F. per. (a) in shade G11361.
S. pallidifusca (*Schumach.*) Stapf & C.E. Hubb.
W. ann. (o) ruderal in ecotones G12939.
S. phleoides Stapf
E. per. top of rift wall badly drainage sites G11831.
S. plicatalis (Hochst.) Engl.
F. per. (a) in shade G11108.
S. trinervia Stapf
P. per. tussock grass (f) fire-induced woodland grassland on hillsides VFG957.
S. verticillata (L.) Beauv.
W. ann. (a) in shade G11327.
Sporobolus consimilis Fresen. (Syn. *S. robustus* auct. non Kunth).
A. per. tussock grass (va) along contact of alkaline flats and woodland G10951.
S. fimbriatus Nees
A. per. bunch grass (f) ecotones bordering alkaline flats disturbed ground VFG5123.
S. helvolus (Trin.) Dur. & Schinz.
E. per. stoloniferous (o) secondary sites on ledges and stream sides VFG5320.
S. marginatus A. Rich.
W. ann./per. (va) redistributed soil and ecotone between woodland and alkaline grasslands G11772; 11811.
S. pellucidus Hochst.
E. per. (o) secondary sites G12054.
S. pyramidalis Beauv.
W. per. tussock grass (f) ecotones and ruderal at secondary sites G11265. VFG6886.
S. spicatus (Vahl) Kunth
A. per. (va) over lake flats G10995.
Tetrapogon cenchriformis (A. Rich.) Clayton
E. ann. (o) ruderal disturbed places G11326.
T. tenellus (Roxb.) Chiov.
E. ann. (o) ruderal disturbed places G11329.
Tragus berteronianus Schult.
W. ann. (f) ruderal and in ecotones G11221.
Tricholaena eichingeri (Mez) Stapf & C.E. Hubb.
per. casual river bed G11385.

Urochloa panicoides Beauv.
W. ann. stoloniferous (o) early seral herbage VFG4865.
U. pullulans Stapf
W. per. (f) ruderal and in ecotones G11278.
U. trichopus (Hochst.) Stapf
W.F. & S. per. (va) ruderal and secondary grassland sites G12037.

Filices **Ferns Fern allies.**

6 Ophioglossaceae

Ophioglossum sp.
W. seasonal growth, locally (a) redistributed soil G11116.

17 Adiantaceae

Actiniopteris radiata (Poir.) Link.
E. growth only during rains rocky crevices G11084
A. semiflabellata Pic.-Ser.
E. ecologically sympatric with above G11152.
Adiantum capillus-veneris L.
F. locally (va) river gorges G11889.
A. incisum Forsk.
E. (o) moist rock crevices G11153.
Doryopteris nickelsii Tard.
E. (r) over-hanging rocks G11039.
Pellaea adiantoides (Willd.) Kaulf.
E. (o) rather dry exposed rock crevices VFG5606.
Pteris vittata L.
F. (f) stream sides G10967.

19 Davalliaceae

Nephorolepis biserrata (Sw.) Schott.
F. locally (a) spring heads 10966.

24 Thelypteridaceae

Cyclosorus dentatus (Forsk.) Cheng.
F. (f) riverine and spring heads G11373.

32 Marsileaceae

Marsilea minuta L.
S. aquatic (a) any muddy verges and pools G11027.

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(Received 14th April, 1971).

P. J Greenway, E. A. Herbarium, P.O. Box 45166, Nairobi
D. F. Vesey-FitzGerald, Arusha National Park, P.O. Box 3134, Arusha

Published by The East Africa Natural History Society, Box 44486, Nairobi, Kenya and printed by Kenya Litho Ltd., Box 40775, Nairobi.